# *A STUDY TO ASSESS THE DEGENERATIVE CHANGES IN LUMBER VERTIBRA – EFFECT OF BMI & AGE*

*Submitted in partial fulfillment of the*

*Requirements for the award of the degree*

*of*

MASTER OF SCIENCE

*In*

MEDICAL IMAGING TECHNOLOGY

*By*

**ANURAG TIWARI**

Enrollment no- (950122461)

Under the supervision

Of

Guide

**Ms. NEELAM RAO BHARTI**

Assistant Professor

Co-Guide:

**MR. HIMANSHU MISHRA**

Assistant Professor

Department of Medical Radiology Imaging Technology

**SANTOSH MEDICAL COLLEGE & DEEMED TO BE UNIVERSITY**
**GHAZIABAD No.1, Sector 12, Santosh Nagar, Pratap Vihar, Ghaziabad, Uttar Pradesh, 201009**

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The Registrar
Santosh Deemed to be University.
Vijay Nagar Ghaziabad-201001 (UP)

Sub: -Registration of thesis for Master of Medical Imaging Technology

Respected Sir,

I request you to kindly consider and register the subject of my thesis entitled **" A Study to Assess the Degenerative Changes in Lumber Vertebra Effect of BMI & Age."** for 2022- 2024 with a view to appearing in the MIT examination in 2024.

Thanking you

**Yours truly**

**Anurag Tiwari**

Post-Graduation Student, Batch 2022-2024
Department of Radio-Imaging Technology
Santosh Medical College and Hospital Ghaziabad - 201001 (U.P.)

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Ghaziabad.

Prof. Dr. Shalabh Gupta
M.B.B.S., M.S
Dean Academics
Faculty of Allied Health Sciences
Santosh Medical College & Hospital
Ghaziabad-201001 (UP)

**SANTOSH UNIVERSITY**

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**Date: -**

**Place: -** Santosh Deemed to be University,

Ghaziabad, Delhi-NCR India

Ms. NEELAM RAO

Assistant Professor &In-charge.

Santosh Medical College & Hospital

SANTOSH
Deemed to be University

## CERTIFICATE BY THE CO-GUIDE

This is to certify that the thesis entitled "***A Study to Assess the Degenerative Changes in Lumber Vertebra Effect of BMI & Age.***"submitted by **Anurag Tiwari** for the partial fulfillment of requirement for the award of degree of **MASTER OF SCIENCE IN MEDICAL IMAGING TECHNOLOGY**, is a bonafide research work carried out under my direct guidance & supervision.

**Date: -**

**Place: -** Santosh Deemed to be University, Ghaziabad, Delhi-NCR India

MR. HIMANSHU MISHRA

Assistant Professor

Santosh Deemed to be University

Ghaziabad, Delhi-NCR India

SANTOSH
Deemed to be University

## CERTIFICATE BY HEAD OF THE DEPARTMENT

This is to certify that the Protocol entitled "***A Study to Assess the Degenerative Changes in Lumber Vertebra Effect of BMI & Age.***" submitted by **Anurag Tiwari** for the partial fulfillment of requirement for the award of degree of **MASTER OF SCIENCE IN MEDICAL IMAGING TECHNOLOGY,** has been presented in the departmental Research Committee of Department of Medical Radiology Imaging Technology at Santosh Medical/Dental College & Hospital, Ghaziabad, NCR, India.

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**Place: -** Santosh Deemed to be University, Ghaziabad, Delhi-NCR India

Dr. ASHOK KUMAR SHARMA

Professor & Head of Department

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**ANURAG TIWARI** **MS. NEELAM RAO**

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All the statistical calculations of this study are authentic and correct to the best of my knowledge.

Wish him all the success in his life.

**Dr. Amod singh**
Assistant Professor cum Bio-Statistician,
Department of community medicine.
Santosh Deemed To be University, Ghaziabad
Email: - amod.ism01@gmail.com

# LIST OF ABBREVIATIONS

| S.NO | | ABBREVIATIONS |
|---|---|---|
| 1 | 3D | 3 Dimensional |
| 2 | BMI | Body Mass Index |
| 3 | CT | Computed tomography |
| 4 | L1 | Lumbar spine vertebra 1 |
| 5 | L5 | Lumbar spine vertebra 5 |
| 6 | LOS | Length of stay |
| 7 | MRI | Magnetic Resonance Imaging |
| 8 | S4 | Sacrum 4 |
| 9 | WHO | World Health Organization |
| 10 | CAT | Computed Axial Tomography |
| 11 | MSCT | Multi Slice Computer Tomography |
| 12 | KG | Kilo Gram |
| 13 | $M^2$ | Meter Square |
| 14 | ASA | American Society of Anesthesiologists |
| 15 | CDC | Centers for Disease Control |
| 16 | AO | Anterior Osteophytes |
| 17 | DSN | Disc Space Narrowing |
| 18 | ICU | Intensive Care Unit |
| 19 | LBA | Lower Back Ache |
| 20 | BW | Body Weight |
| 21 | LSS | Lumbar Spinal Stenosis |
| 22 | DISH | Diffuse Idiopathic Skeletal Hyperostosis |

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## CHAPTER - 1

## INTRODUCTION

### 1.1 lumber spine

The lumbar spine, also known as the lower back, is the region of the spine located in the lower part of the back, below the thoracic spine and above the sacral spine. It consists of five vertebrae (L1-L5) that are larger and heavier than the vertebrae in the thoracic and cervical spine, as they bear more weight and stress due to the body's movements and activities.

The lumbar spine is flexible and allows for bending, twisting, and weight-bearing activities. It supports the upper body and protects the spinal cord and nerves that run through the spinal canal. The intervertebral discs between each vertebra act as cushions and help absorb shock during movement. The lumbar spine is prone to various conditions and injuries, including disc herniation, spinal stenosis, spondylolisthesis, sciatica, and degenerative disc disease. Symptoms of lumbar spine issues may include lower back pain, leg pain or weakness, numbness or tingling in the legs, and difficulty walking or standing.

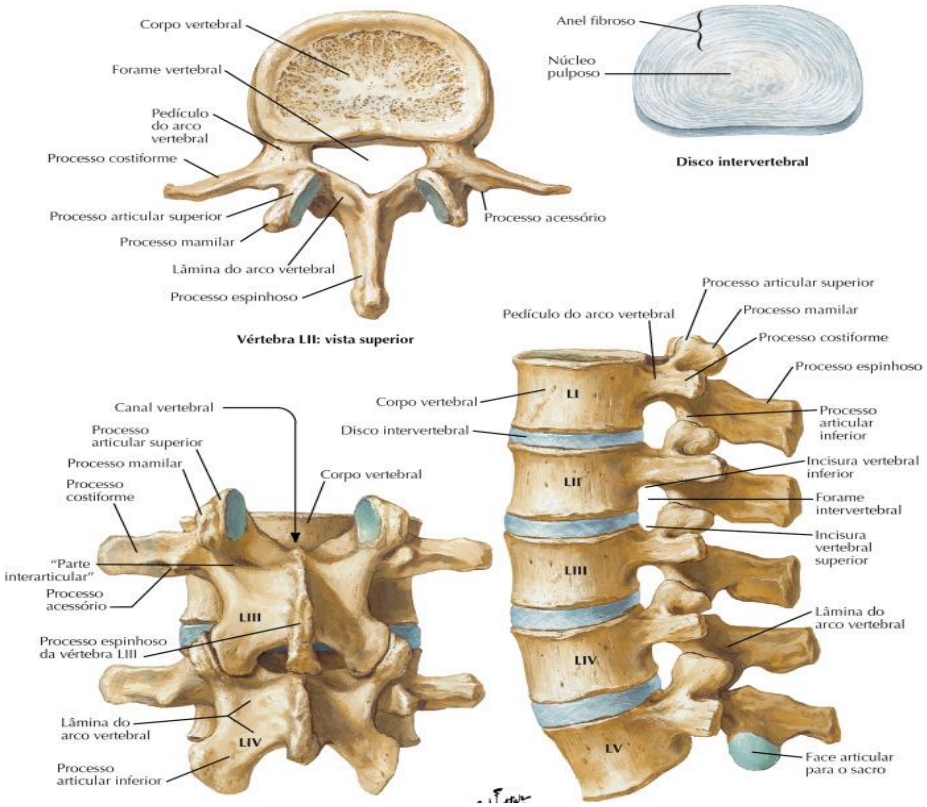



*Fig 1: -An axial view of a lumber vertebra is shown in the upper left image of a normal lumber spine anatomy, while the intravertebral disc is seen on the right side. A posterior image of a lumber vertebra with transverse prosses is displayed at the bottom. Additionally, the right side has a lumber vertebra in its typical state.*

Lower back pain due to degenerative disc disease is a common condition affecting young to middle-aged individuals, with a peak incidence around 40 years. The main symptom is sciatica, a sharp shooting pain that can radiate to the calf or sole of the foot and aggravates with standing, walking, bending, straining, and coughing. Patients with lumbar disc degenerative disease may experience sensory disturbances in legs, claudication, and relief with bending forwards. Risk factors include advancing age, smoking, obesity, trauma, heavy weight lifting, height, genetic factors, and hereditary factors. Certain occupations like machine drivers, carpenters, and office workers are also associated with the condition. This study aims to evaluate the relationship between lumbar degenerative disc and vertebra disease and CT findings, which can help visualize gross anatomic changes in the intervertebral disc and lumber vertebra column.

### 1.2 Degenerative changes

Degenerative changes in the spine are a common aspect of aging and can affect various structures, including the intervertebral discs, facet joints, ligaments, and vertebral bodies. These changes often lead to conditions such as osteoarthritis, disc herniation, and spinal stenosis. The intervertebral discs, which act as cushions between the vertebrae, may lose hydration and elasticity over time, resulting in reduced disc height and potential disc bulging. This can put pressure on adjacent nerves, leading to pain, tingling, or numbness [2].

The facet joints, which provide stability and facilitate movement, may also undergo degeneration. Cartilage within these joints can wear away, causing bones to rub against each other and leading to inflammation and pain. Ligamentous structures, responsible for maintaining spinal alignment, can become less flexible and more susceptible to injury as they age. The degeneration of these ligaments can contribute to abnormal spine motion and alignment issues. Additionally, the vertebral bodies themselves may develop osteophytes, or bone spurs, which can impinge on spinal nerves or the spinal cord. Spinal stenosis, a narrowing of the spinal canal, can result from these degenerative processes, leading to significant discomfort and mobility issues.

Many individuals with degenerative spinal changes experience chronic pain, which can severely impact the quality of life. Risk factors such as genetics, obesity, smoking, and repetitive stress can exacerbate these changes. Early diagnosis and intervention are crucial for managing symptoms and preventing further degeneration. Non-surgical treatments, including physical therapy, medications, and lifestyle modifications, can help alleviate pain and improve function. In more severe cases, surgical options like spinal fusion or decompression may be necessary to stabilize the spine and relieve pressure on neural structures. Preventative measures, such as regular exercise, maintaining a healthy weight, and avoiding tobacco use, can mitigate the progression of degenerative changes. Understanding the natural aging process of the spine can

empower individuals to take proactive steps for spinal health. By combining medical treatment with lifestyle adjustments, it is possible to manage the symptoms effectively and maintain a good quality of life despite the presence of degenerative spinal changes.

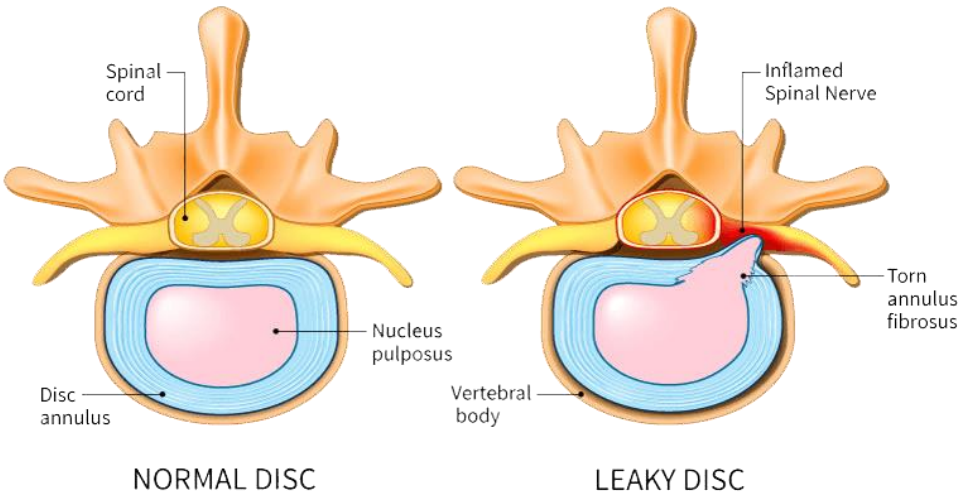



Fig. 2. torn of the annulus fibrosus. Fissures of the annulus fibrosus occur as radial (R), transverse (T), and/or concentric.

It is important to maintain proper posture, engage in regular exercise, lift objects correctly, and avoid repetitive bending or twisting movements to help prevent lumbar spine injuries and maintain spine health. Consulting with a healthcare provider or spine specialist can help address any concerns or symptoms related to lumbar spine conditions.

## 1.3 DIAGONSIS

Diagnosis of lumbar spine conditions often involves imaging tests such as X-rays, MRI, or CT scans to assess the alignment of the vertebrae, disc health, and any signs of nerve compression or damage. Treatment options for lumbar spine conditions may include rest, physical therapy, medications, injections, or in severe cases, surgery.

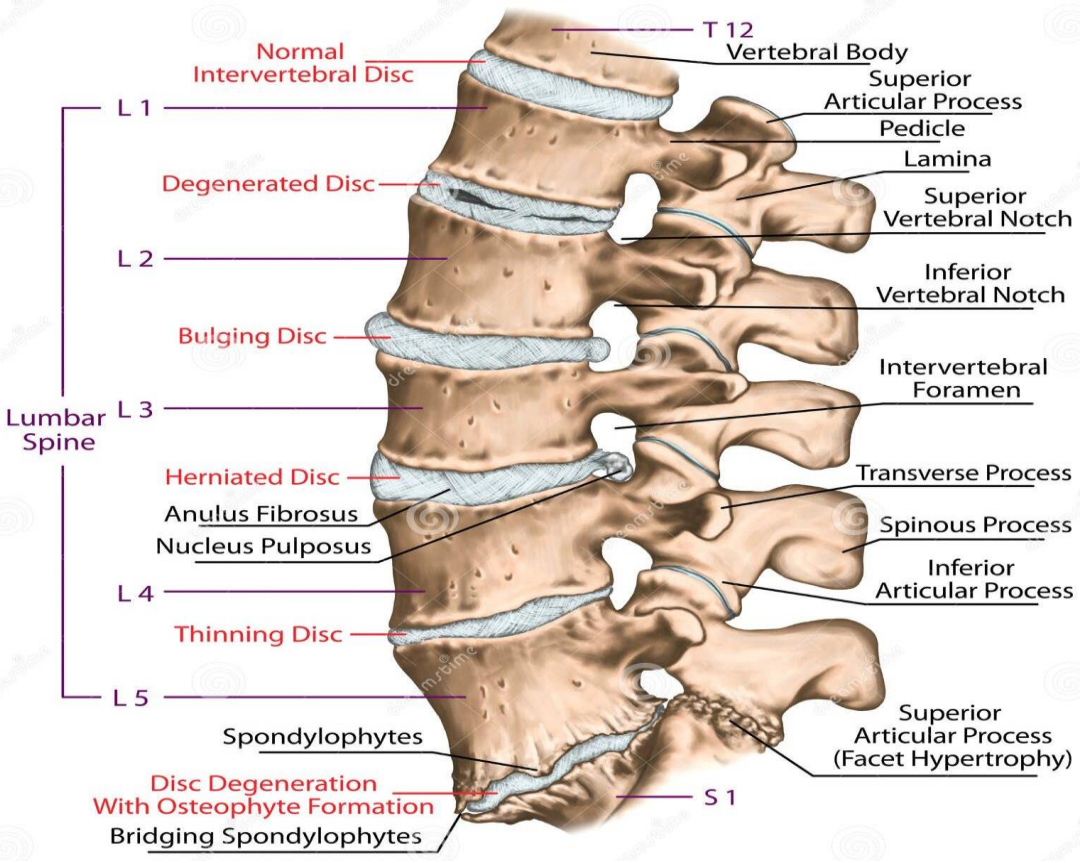



*Fig. 3. Normal lumbar disc. Top firstvertibra, sagittal, and (Bottom) are showing osteophytes and in the mid or l3 dis is herniated degenerative changes.*

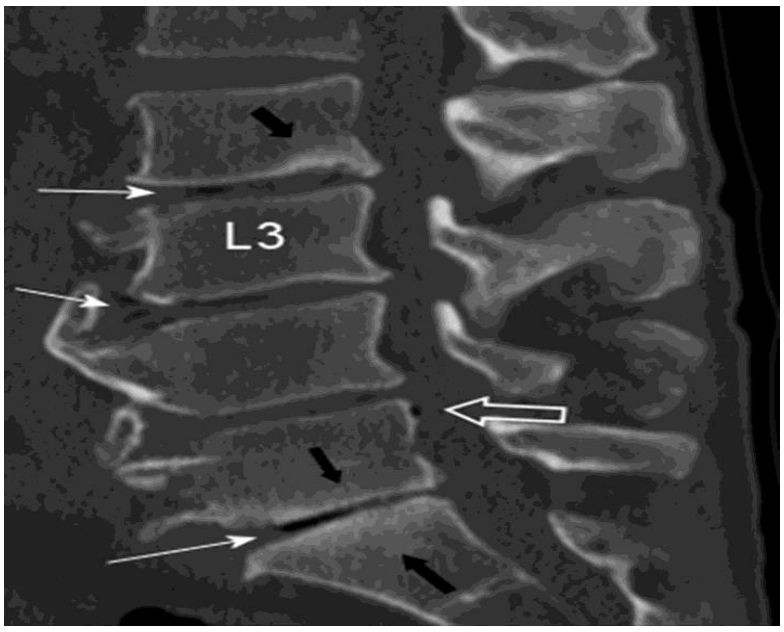



*Fig 4: - Types of disc degeneration by radiographic criteria.*

## 1.4 CT SCAN

### 1.4.1 INTRODUCTION

Computed tomography (CT) is a computerized x-ray imaging procedure that uses a narrow beam of x-rays to rotate around a patient's body, producing signals that are processed by the machine to generate cross-sectional images or "slices." These slices, called tomographic images, provide clinicians with more detailed information than conventional x-rays. They can be digitally stacked to form a three-dimensional (3D) image.

CT scans are essential for identifying diseases and injuries in various body regions, such as the abdomen, heart, head, lungs, and bone fractures. They can detect tumors, lesions, clots, stroke, hemorrhage, tumors, pulmonary embolisms, excess fluid, and conditions like emphysema or pneumonia. CT scans produce more detail than conventional x-rays, making them useful for imaging complex bone fractures, eroded joints, and bone tumors.

Fig.5 CT scan machine external structure.

Computed Tomography (CT) scan, also known as Computed Axial Tomography (CAT) scan, is a non-invasive medical imaging test that uses X-rays and computer technology to produce detailed cross-sectional images of the body. It helps diagnose a wide range of medical conditions, including injuries, cancers, vascular diseases, and internal organ problems.

**1.4.2 Generation of CT scan:**

The development of CT scan technology has gone through several generations, each with significant improvements:

1. First Generation (1971): The first CT scanner was developed by Godfrey Hounsfield and Allan McLeod Cormack, using a single X-ray beam and detector.
2. Second Generation (1975): Introduced fan-beam technology, increasing scan speed and image quality.
3. Third Generation (1978): Featured a rotating X-ray tube and detector, further improving scan speed and resolution.
4. Fourth Generation (1980s): Saw the introduction of spiral CT scanners, enabling continuous scanning and faster image acquisition.
5. Fifth Generation (1990s): Developed multislice CT scanners, allowing for multiple slices to be imaged simultaneously.
6. Sixth Generation (2000s): Introduced dual-source CT scanners, providing higher resolution and faster scan times.
7. Seventh Generation (2010s): Featured high-definition CT scanners with improved image quality and reduced radiation doses.

Each generation has led to significant advancements in CT scan technology, enabling faster, higher-quality imaging, and improved diagnostic capabilities.

A CT scanner uses a motorized x-ray source that rotates around a gantry, allowing the patient to lie on a bed that moves through the gantry. The x-ray tube shoots narrow beams of x-rays through the body, using digital detectors instead of film. The x-rays are picked up by the detectors and transmitted to a computer. The computer uses mathematical techniques to construct a two-dimensional image slice of the patient, with tissue thickness ranging from 1-10 millimeters. The image is stored and the motorized bed is moved incrementally into the gantry. The process continues until the desired number of slices is collected. The computer displays the image slices individually or stacked together, generating a 3D image of the patient, showing the skeleton, organs, tissues, and any abnormalities.

CT scanning of the lumbar spine is a non-invasive diagnostic imaging test that uses X-rays and computer technology to produce detailed cross-sectional images of the lower back. Here's a breakdown of the process and what it can help diagnose:

### 1.4.3 ACQUSISTION OF CT DATA

The word data collection mention to the measuring of a patient's X –ray transmission. They found specific electronic detectors that assess transmission value or attenuation value after the X-ray has gone through the body. To comply with the rebuild criteria, sufficient measurement or transmission data must be recorded. The first brain scanner to adopt the data gathering technique in which the tube of X-ray and detector as they move From left to right, they could either travel in a single direction or move across the patient' s head to get infusion amount information. The tube of x-ray and detector than rotate 1 level and return to the skull of patients, this time from right to left. Scanning is a rotational operation that is done 180 degrees.

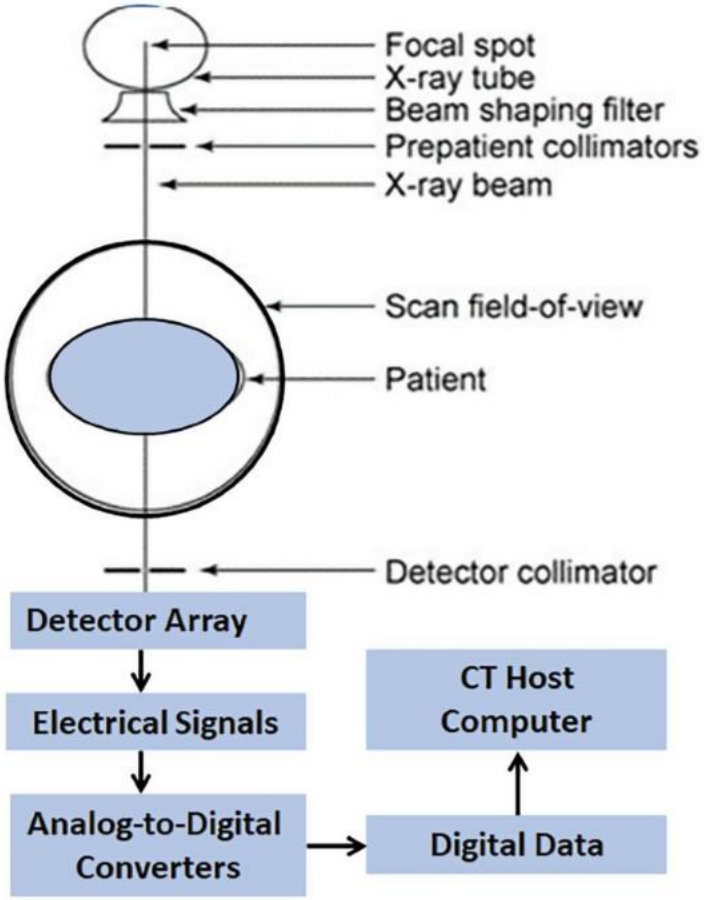



**Fig 6 The Data Acquisition in Computed Tomography**

### 1.4.4 The Data Acquisition in Computer Tomography

The main issue with this approach is the amount of time it takes to collect enough data to rebuild the image. More efficient programmer for scanning patients were introduced a short time afterwards. These modes are associated with the even as patient moves through the scanner, the x-ray tube and detector revolve simultaneously at the same time. This method results in the digitization of a larger rather than a single slice of tissue, a volume of tissue is used like the original CT scanner did. Mass analysis is now used to describe having only one tissue volume during scanning.

The helical trajectory recorded by an X -ray beam is produced by the constant rotation of detector and tube, as well as the patient's movement. Volumetric analysis has two goals: to increase the pace of covers as well as the provide better features for clinical applications Data collection includes converting electrical signals received from electronic equipment to digital data detectors that computer can use.

**(a) HELICAL OR SPIRAL COMPUTER TOMOGRAPHY**

This is possible with help of slip ring technology, where the X-ray tube in the CT table are continuously incrementing and continuously rotating. This causes the tube of X-ray to form a fictitious spiral or spiral path around the CT patient.

**(b) MULTI-SLICE COMPUTER TOMOGRAPHY**

Multi-slice CT (MSCT) is a scanning operation provide by multiple sets of indicators to generate perceptions associated with different segments. This system has characteristics that are incompatible with standard scanner placements, so individual screening indicators must be used. This pioneering achievement of this forehead display mode, which includes federation in addition to complex questions, significantly facilitates this performance of the scanner in the direction of the phase in terms of perceptual scale, learning time, and interpretation.

**(c) MULTI-DETECTORCOMPUTERTOMOGRAPHY**

When using multiple detector arrays, the collimation array is wider and uses the number of photons provided by a specialized X-ray device to generate evidence of perception. When starting a collimator with a single array scanner, the slice thickness tends to increase, minimizing image quality in the pixel size dimension. For some detector array scanner, the slice thickness is determined by the size of the detector, not the collimator.

## (d) IMAGE RECONSTUCTION TECHNIQUE

Image similar is a geometric process that comprehensively guides the perception of the evidence of numerous ray prominences to several different gradients through the victim. Algorithms are geometric processes used to solve the problems. Describes the followings triangulation techniques for perceptual recovery.

i. **BACK -PROJECTION:** Demands rarely stands out backwards, but it is ―approaching sum‖, meaning the most outdated means of reshaping prescription. None of the CT scanner on the market use simple back projection, but I'll use it as a prototype because it's the easiest way to explain this.

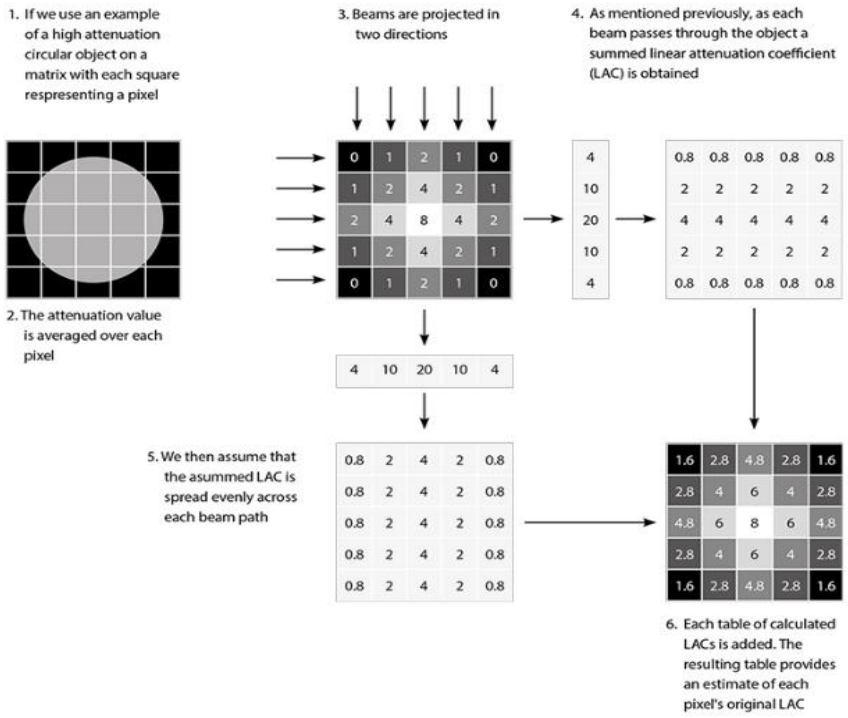

1. If we use an example of a high attenuation circular object on a matrix with each square respresenting a pixel
2. The attenuation value is averaged over each pixel
3. Beams are projected in two directions
4. As mentioned previously, as each beam passes through the object a summed linear attenuation coefficient (LAC) is obtained
5. We then assume that the asummed LAC is spread evenly across each beam path
6. Each table of calculated LACs is added. The resulting table provides an estimate of each pixel's original LAC

**Fig 7: BACK PROJECTION**

ii. **ITERACTION METHODS:** Repeated mods start next to assumption that are specified only within each pattern, for example. Also, the above assumption is calculated next to the contained characters so that these pairs can be repeated in the communication and wait for future expectations. Moral. There are three variations of iterative reconstruction, depending on whether the correction sequence contains an entire matrix, a ray, or a single point.

iii. **SIMULTANEOUS RECONSTRUCTION:** At the beginning of the iteration, all estimates are determining for the entire matrix and all improvement are made for each interaction at the same time. The single ray calculation is highly valued, the repaired improvements are integrated into the next ray calculation, and each interaction repeats the progression of the individual ray.

iv. **POINT CORRECTION:** Measurements and corrections are arranged to allow all ray traveling within individual duration. In addition, this improvement recently effected the supplementary clause, and this has been reproduced for all durations.

v. **SYSTEMIC PROCESS:** The systematic process was the last process to work on any device today. These algorithms transform the iterative process into the exact specifications recently used in connection with these scientific rehabilitations. These formulas are surprisingly complex for most radiologist, but mathematicians say they are actually quite simple. we will only try to illustrate two common analytical methods, two dimensions Fourier decomposition, including sophisticated celebrities. all the foundations of Fourier analysis mean that virtually any number of frequencies and loop ratios can achieve all objectives over time.

**VOLUME IMAGING**: it's important note to mix it up with volume rendering. Virtual reality is type of estimate imaging, whereas volume imaging creates a true three-dimensional visualization mode. These innovations explored include holography, stereoscopy displays anaglyphic approaches, varifocal mirror, Synthalyzers, and rotating multi diode arrays.

**3D MEDICAL IMAGING:** Doctor gasorherman of the Pennulsylvania university's medical imaging process in group explain medical imaging in 3 dimensions as—a process that begins with a stack of selections slices collected by some medical imaging devices and ends with computer generated

displays that facilitate the visualization of underlaying spatial relationships‖ according to uddupa and Herman (2000), the team 3D imaging refers to four types of three-dimensional operations —processing, visualization, manipulation, and analysis.

**VOLUME RENDERING**: When compared to surface rendering techniques, it is a more advanced technology for creating three-dimensional photography with superior image resolution and more data it solved some of the constraints of surface representation by using the whole data set from 3d space. As a consequence, volume rendering needs more processing power and is therefore more effective then surface rendering.

**1.4.5 Patient Preparation:**

- Remove metal objects like jewelry, glasses, or clothing with metal fasteners
- Wear a hospital gown

**1.4.6Scan Procedure:**

- Lie on a table that slides into the CT scanner
- Scanner rotates around your body, taking X-rays from multiple angles
- Images are reconstructed into detailed slices of the lumbar spine.

**1.4.7 Diagnose**

- Herniated discs or bulging discs
- Degenerative disc disease or spinal stenosis
- Spondylolisthesis (vertebral slipping)
- Fractures or spinal injuries
- Infections like osteomyelitis or abscesses
- Tumors or spinal metastases
- Congenital conditions like spina bifida.

**1.4.8 BENEFITS:**

- Quick and painless
- High-resolution images
- Non-invasive, no surgery or hospitalization required
- Low radiation exposure.

**1.4.9Risks:**

- Radiation exposure (though minimal).
- Allergic reactions to contrast dye.

Keep in mind that CT SCANS, MRI, X-RAY are just one diagnostic tool, and your doctor may recommend additional tests or examinations to confirm a diagnosis.

**1.6 BMI: -**

**1.6.1 INTRODUCTION**

Healthcare practitioners can evaluate a person's risk for chronic illness with the use of the BMI. BMI calculates an individual's ideal health based on height and weight. Adults' BMI (18 years and older) Calculate Your BMI: Use the chart below to find your height and weight. Your BMI is represented by the number. There's more to your BMI than just a score. You have the optimal level of body fat, which is linked to the longest lifespan and the lowest risk of sickness, if your BMI is between 20 and 22. A BMI of 22 to 25 is considered normal and is linked to excellent health. • If your BMI falls between 25 and 30, you are deemed overweight and need to learn how to reduce your weight with food and exercise. When applying BMI to youngsters, it is not the same as it is to adults. Body mass index is used to evaluate underweight, overweight, and overweight risk in children and adolescents. As children develop, their body fat percentage varies over time. As they become older, males and girls have different levels of body fat. For this reason, BMI for kids, also known as BMI-for-age, is age- and gender-specific. Growth charts tailored to a certain gender display BMI-for-age data. The age range for these growth charts is 2 to 20 years old for children and teenagers. To get the CDC's 2000 Growth figures and other details, go to the National Center for Health Statistics.

Take a measurement of your waist circumference by wrapping a measuring tape around it firmly. It is a reliable sign of your belly fat, which is another measure of your susceptibility to heart disease and other risk factors. A waist measurement of more than 40 inches for males and more than 35 inches for women raises this risk.

We find that the real prevalence of obesity in the white population, especially among young and old males, may be underestimated when utilizing a BMI threshold. Furthermore, we note that the prevalence of underweight for both sexes may be underestimated in the community if a BMI threshold is used to measure it. We propose defining underweight and obesity in terms of body fat using optimum sex- and age-specific thresholds, acknowledging that these definitions will rely on risk assessment for illness, morbidity, and death.

We found scientific journal papers from 2000 to 2023 that were disseminated in connection to BMI by searching the PubMed database and different article references. After using the search phrase "body mass index," the reported inquiry turned up 32 publications that show how BMI is associated to various metabolic diseases such as diabetes, hypertension, and death from illness. In addition, papers about the association between BMI, waist circumference, waist-hip ratio, youth BMI as a wellbeing indicator, and the limits of BMI as a tool for health evaluation were found through the search. Based on the data from earlier studies, a general population-wide association between BMI and characteristics associated with chronic illness may be drawn.

### 1.6.2 Adult BMI table

This is the recommended body weight for adults by the World Health Organization (WHO), based on BMI measurements. Men and women who are 20 years of age or older can utilize it.

| Classification | BMI range - $kg/m^2$ |
|---|---|
| Severe Thinness | < 16 |
| Moderate Thinness | 16 - 17 |
| Mild Thinness | 17 - 18.5 |
| Normal | 18.5 - 25 |
| Overweight | 25 - 30 |
| Obese Class I | 30 - 35 |
| Obese Class II | 35 - 40 |
| Obese Class III | > 40 |

**Table. 1 BMI Range in several classification**

### 1.6.3 BMI calculation

The following formulas are used to calculate BMI in the International System of Units (SI):

**SI, Metric Units:**

$$BMI = \frac{\text{mass (kg)}}{\text{height}^2 \text{ (m)}}$$

### 1.6.4Adult BMI chart

Based on statistics from the World Health Organization, this graph shows the various BMI classifications. A main categorization's subgroups are indicated by the dashed lines.

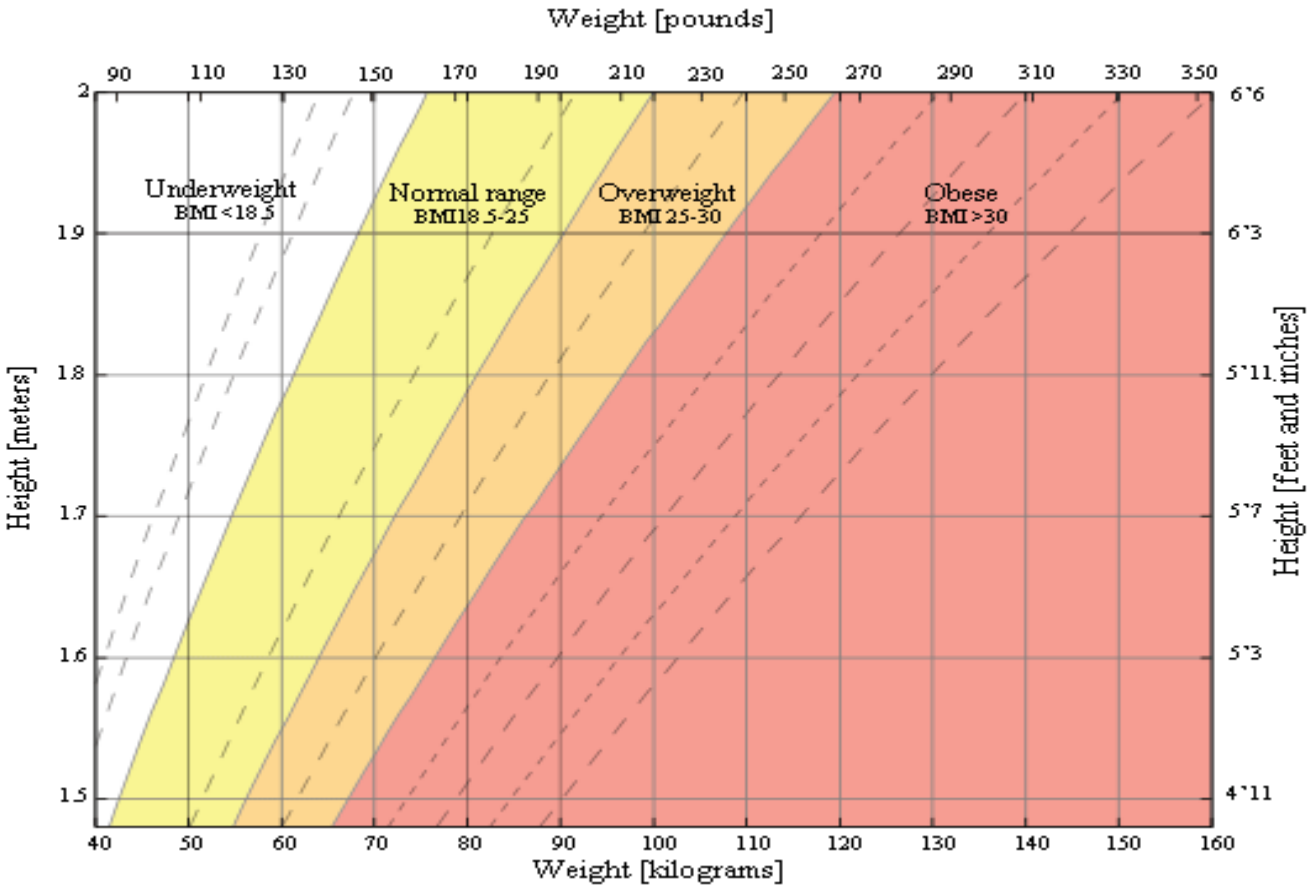



**Fig 10:** Various BMI classifications

### 1.6.5 WHO

According to the world health organization BMI is a simple index of weight-to-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m2).

## Need for study

The primary goal of this research is early calculation of degenerative changes in lumber spine with increasing obesity in age.People can presumption how to fend us in time or cure his obesity with the aid of this study.

# CHAPTER - 2
# AIMS AND OBJECTIVES

## 2.1 AIM

A Study to Assess the Degenerative Changes in Lumber Vertebra Effect of BMI & Age.

## 2.2 OBJECTIVE

- Evaluation of facet joint degenerative changes.
- Assess of spinal cord compression.
- Degenerative disc disease of the spine.
- Describe the elements of a correct examination and assessment, together with any recommended imaging investigations, for a patient who presents with lumbar degenerative disc disease.

## CHAPTER-3
## REVIEW OF LITRATURE

**3.1** World Health Organization Technical Report in 20000 **Obesity: preventing and managing the global epidemic. Report of a WHO consultation**. An increasing number of nations are witnessing a sharp rise in the harm that overweight and obesity pose to public health. Indeed, they are now so prevalent that they are overtaking more conventional issues like malnutrition and infectious illnesses as the main contributors to poor health. A number of conditions are associated with obesity, such as dyslipidemia, gout, osteoarthritis, coronary heart disease, hypertension, stroke, certain cancers, gallbladder disease, diabetes mellitus that is not insulin-dependent, pulmonary disorders, and sleep apnea. Obese people also experience societal bias, prejudice, and discrimination from both the general public and medical professionals, which may discourage them from seeking medical attention. WHO consequently organized a Consultation on Obesity in order to examine the most recent epidemiological data, contributing variables, and related outcomes.

**3.2** G. Hassett, D. J. Hart, N. J. Manek, D. V. Doyle, T. D. Spector study in 04 November 2003. **Risk factors for progression of lumbar spine disc degeneration**: The Chingford Study This study aimed to examine the radiographic progression of lumbar spine disc degeneration over 9 years in a population-based cohort of women from the Chingford Study. The study involved 796 paired lumbar spine radiographs for anterior osteophytes (AO) and disc space narrowing (DSN) at each lumbar disc space (L1–5). Disc degeneration was defined using thresholds of AO and DSN grade 1+ in one or more vertebrae within a subject. Progression was defined as an increase in grade in an affected year-1 vertebra. Potential risk factors were assessed using odds ratios and 95% confidence intervals adjusted for age, body mass index (BMI), and other potential confounders in logistic regression models using the STATA statistical package. The mean age at baseline was 53.8 ± 6.0 years, and the mean BMI was 25.4 ± 4.1 kg/m2. Progression rates for AO and DSN were 4% per annum and 3% per annum, respectively. Important risk factors for progression included age, back pain, and radiographic hip and knee osteoarthritis (OA).

**3.3** Battié, Michele C. PhD; Videman, Tapio MD, Dr. MedSci; Parent, Eric MSc study in December 2004 **Lumbar Disc Degeneration Epidemiology and Genetic Influences.** To synthesize the scientific literature on the prevalence of lumbar disc degeneration and factors associated with its occurrence, including genetic influences.A literature review was conducted of the prevalence of disc degeneration.Studies of the etiology of disc degeneration were summarized, with particular attention given to studies of genetic influences.Previously, heavy physical loading was the main suspected risk factor for disc

degeneration.However, results of exposure-discordant monozygotic and classic twin studies suggest that physical loading specific to occupation and sport has a relatively minor role in disc degeneration, beyond that of upright postures and routine activities of daily living.Recent research indicates that heredity has a dominant role in disc degeneration, explaining 74% of the variance in adult populations studied to date.Since 1998, genetic influences have been confirmed by the identification of several gene forms associated with disc degeneration.

**3.4** M.Liuke1, S Solovieva1, A Lamminen, K Luoma, PLeino-Arjas, R Luukkonen and H Riihima. study in 17 May 2005 **Disc degeneration of the lumbar spine in relation to overweight.** Investigate the link between overweight and lumbar disc degeneration. Plan: Conduct a population-based 4-year follow-up MRI study. 129 middle-aged men were selected for an MRI study from a group of 1832 men working in three occupations (machine drivers, construction carpenters, and office workers) based on their age (40-45 years) and place of residence. MR images of the lumbar spines were obtained at standard and 4-year follow-up. Two readers assessed the focal bulging of the intervertebral discs L2/L3–L4/L5 using adjacent cerebrospinal fluid as a reference. The study measured the weight and height of the subjects at ages 25 and 40-45. It also assessed their history of car driving, smoking, and back wounds through a survey. The results showed that persistent overweight (BMI of 25 kg/m2 or higher at both ages) was strongly associated with an increased risk of lumbar disc degeneration at follow-up. The adjusted odds ratio was 4. 3-14 (95% CI) Being overweight at a young age (RR 3). 8; 95% CI 1.4-10 RR 1.3; 95% CI 0.4 indicated an increase in deteriorated circles during follow-up, with overweight as a lesser factor. CONCLUSIONS: The study shows that a BMI over 25 kg/m2 increases the risk of lumbar disc degeneration, especially in overweight individuals at a young age. "Here are some tips to help you save money while still enjoying your favorite hobbies. First, consider looking for discounts or sales when purchasing supplies or equipment. Next, try finding free or low-cost alternatives for certain activities. Additionally, consider sharing resources or participating in group activities to split costs. Lastly, try budgeting a set amount each month specifically for your hobbies. By implementing these strategies, you can continue pursuing your interests without breaking the bank."

**3.5** Katherine M Flegal1 , John A Shepherd 1 , Anne C Looker 1 , Barry I Grau bard 1 , Lori G Borrud 1 , Cynthia L Ogden 1 , Tamara B Harris 1 , James E Everhart 1 , Nathaniel Schenker 1Received 16 August 2008 **the** study examines the correlations between percentage fat, BMI, weight control, and weight loss (WC) and body mass index (BMI) by sex and age group. Results show that men have higher correlations with percentage fat and BMI than women, except in the oldest age group. Women also have higher correlations with BMI than with WC, but only for women aged 40-59 years. WSR is slightly more correlated with percentage fat than WC alone, but only in the youngest age group for both men and women. WC and BMI are more highly correlated with each other than percentage fat and WSR.

**3.6** Yuichi Kasai, EijiKawakita, Toshihiko Sakakibara,Koji Akeda, and Atsumasa Uchida published study in 2009. **Direction of the formation of anterior lumbar vertebral osteophytes**. The direction of the formation of 14,250 pairs of anterior lumbar vertebral osteophytes across the adjacent intervertebral discs in 2,850 patients who were all over 60 years old was investigated. Anterior lumbar vertebral osteophytes were distributed into six groups based on the direction of extension of each pair of osteophytes across the intervertebral disc space.In L1–L2 and L2–L3, the number of patients classified into groups B (the pair of osteophytes extended in the direction of the adjacent disc) and C (almost complete bone bridge formation by a pair of osteophytes across the intervertebral disc space) was larger than that classified into group D (the pair of osteophytes extended in a direction away from the adjacent disc). In L3–L4, L4–L5 and L5-S1, the number of patients in group D was greater than that of patients belonging to groups B and C.Our study showed that pairs of osteophytes frequently formed in the direction of the adjacent disc in the upper lumbar vertebrae (L1–L2 and L2–L3) and in the direction away from the adjacent disc in middle or lower lumbar vertebrae (L3–L4, L4–L5, and L5-S1).

**3.7** Rahman Shiri, JaroKarppinen, PäiviLeino-Arjas, Svetlana Solovieva, EiraViikari-Juntura, studyin 15 January 2010. **The Association Between Obesity and Low Back Pain.Obesity** is a growing public health concern, contributing significantly to chronic medical conditions and a high economic burden on healthcare systems. Low back pain is a common health problem, causing work-related disability and sickness absence. The association between obesity and low back pain remains controversial, with few reviews published. This systematic literature review aimed to provide a comprehensive analysis of the association between overweight/obesity and low back pain and estimate its magnitude using meta-analysis. Cross-sectional and cohort studies were analyzed separately to address causality. The review identified 263 relevant study reports on the associations between cardiovascular risk factors and low back pain, with 95 included in the systematic review. However, 95 were excluded from the meta-analysis due to selection bias, no combinable outcome, focus on only weight without adjusted risk estimate, and no combinable studies. Consequently, 33 studies qualified for meta-analyses, including 24 cross-sectional and 9 cohort studies.

**3.8** Lisa A Zukowski, Anthony B Falsetti, and Mark D Tillmanhas a study in 2011**.The influence of sex, age and BMI on the degeneration of the lumbar spine.**Osteophytes on vertebral bodies and laminae are common and can cause pain and restrict movement. They are particularly prevalent in the lumbar vertebrae due to bipedal locomotion demands. Osteophytes have been extensively studied and scored to examine patterns of sex, age, and ethnicity. However, laminar osteophytes are rarely mentioned in literature. Osteophytes are described as bony outgrowths on joint margins, but no clear definition

exists. Some researchers have distinguished between true osteophytes, or traction spurs, and claw-type osteophytes, or enthesophytes, which are defined as an ossification of the anterior longitudinal ligament. This study treats the different vertebral body osteophyte types as a single form of degeneration. Differentiating between laminar and apophyseal osteophytes can be difficult due to the close proximity of vertebral laminae and articular facets. A consensus suggests that body osteophytes increase in severity on the lower lumbar vertebrae.

**3.9** Status Samartzis. Dino DS. Karppinen. Jaro MD. Florence. Daniel Y.T. Keith D.K. study in 6 april 2011 **A Population-Based Study of Juvenile Disc Degeneration and Its Association with Overweight and Obesity, Low Back Pain, and Diminished Functional.**The aim of this study was to assess the prevalence, determinants and clinical significance of lumbar juvenile disc degeneration in individuals without spinal deformities. In 1989, a cross-sectional evaluation of volunteers from southern China was conducted and divided into two groups: those with juvenile disc degeneration and those without juvenile disc degeneration. Sagittal T2-weighted magnetic resonance imaging (MRI) was used to evaluate disc degeneration and other spinal findings.The results showed that juvenile disc degeneration occurred in 35% of young people without spinal deformity. Disc bulging or extrusion, high-intensity zones on MRI, and greater weight and height were significantly more common in patients with juvenile disc degeneration. Asian modified body mass index (BMI) overweight or obese subjects had a significant association with juvenile disc degeneration. Overweight and obese people had more severe disc degeneration than underweight and normal weight people. Individuals with juvenile disc degeneration had greater low back pain and/or sciatica, lower back pain severity, reduced social functioning, and greater physical disability than those without disc degeneration. Research affects public health in the development of overweight and obesity and diseases of the lumbar spine.

**3.10** SANG YOON LEE, WON KIM, had a crosssectional study study in 2012.**Relationship between obesity and lumbarspine degeneration**: in this study they find that Their evalence of obesity was more frequent in women than in men (38.27% vs. 33.97%). Compared with normal weight women, the risk of degenerative changes was increased in overweight and obese women following adjustments When obesity was subdivided, the obese II group showed higher odds for LSD in women. However, obesity was not correlated with LSD in men. There was no significant association between obesity and LBP in either men or women.

**3.11** Helen L. Walls, Christopher E. Stevenson, Haider R. Mannan, Ansari Abdullah, Christopher M. Reid, John J. McNeil, Anna Peters. study in 06 September 2012. Comparing Trends in BMI and Waist CircumferenceThe study found that between

1988-1994 and 2005-2006, there were increases in body mass index (BMI) and waist circumference (WC) among non-Hispanic whites and non-Hispanic blacks and Mexican Americans. The proportion of high school completion also increased. However, after adjusting for sex, age, race-ethnicity, and education, BMI increased by 1.8 kg/m2 and WC by 4.7 cm. WC increased independently in all three BMI categories, with individuals in the normal-weight, overweight, and obese groups having WC 0.6, 0.8, and 1.0 cm larger than those in 1988-1994. The proportion of higher-risk WC increased for males and females aged <50 years in each BMI category.

**3.12** F. Reed Murtagh, Stephen L. Gabriel Rothman, Gordon K. Sze, study in 23 July 2013; revised 17 March 2014. **Lumbar disc nomenclature: version 2.0** Recommendations of the combined task forces of the North American Spine Society, the American Society of Spine Radiology and the American Society of Neuroradiology**.** The paper `'Nomenclature and classification of lumbar plate pathology, suggestions of the combined errand strengths of the North American Spine Society, the American Society of Spine Radiology and the American Society of Neuroradiology," was distributed in 2001 in Spine (Lippincott, Williams &Wilkins).It was created by David Fardon, MD, and Pierre Miette MD, and formally embraced by the American Society of Spine Radiology (ASSR), American Society of Neuroradiology (ASNR), and North American Spine Society (NASS).Since 2001, there has been adequate advancement in our understanding of the lumbar plate to recommend the require for amendment and upgrading of the initial archive.The changed report is displayed here, and it speaks to the agreement proposals of modern combined assignment powers of the ASSR, ASNR, and NASS.The errand constrains individuals separately and collectively surveyed the writing and changed the 2001 archive.The changed archive was at that point submitted for survey to the overseeing sheets of the ASSR, ASNR, and NASS.

**3.13** Ryan F. Planchard1, Dominique M. Higgins1, Grant W. Mallory1 Ross C. Puffer1 Jeffrey T. Jacob1 Timothy B. Curry2 Daryl J. Kor2 Michelle J. Clarke1 Study in October in 2014 **The Impact of Obesity on Perioperative Resource Utilization after Elective Spine Surgery for Degenerative Disease**. Design Retrospective case series. Objective To determine the effect of obesity on the resource utilization and cost in 3270 consecutive patients undergoing elective non-instrumented decompressive surgeries for degenerative spine disease at Mayo Clinic Rochester between 2005 and 2012.Groups were assessed for baseline differences (age, gender, and American Society of Anesthesiologists [ASA] classification, procedure type, and number of operative levels). Outcome variables included the transfusion requirements during surgery, the total anesthesia and surgical times, intensive care unit (ICU) admissions, standardized costs, as well as the ICU and hospital length of stay (LOS). Regression analysis was used to evaluate for strength of association between obesity and outcome

variables. Baseline differences between the groups (nonobese: n ¼ 1,853; obese: n ¼ 1,417) were found with respect to age, ASA class, gender, procedure type, and number of operative levels. After correcting for differences, we found significant associations between obesity and surgical ($p < 0.0001$) and anesthesia times ($p < 0.0001$) and hospital LOS ($p < 0.0001$). Additionally, ICU admission rates (p ¼ 0.02) and requirement for postoperative ventilation (p ¼ 0.048) were significantly higher in obese patients. Finally, mean difference in total cost ($1,632, $p < 0.0001$) was significantly higher for the obese cohort. Conclusion Obesity is associated with increased resource utilization and cost in patients undergoing a no instrumented decompressive surgery for degenerative spine disease.

**3.14** Authorlinks open overlay panelM. Hajihosseinali, N. Arjmand, A. Shirazi-Adl study in 21January 2015 **Effect of body weight on spinal loads in various activities: A personalized biomechanical modeling approach.** Low back pain (LBP) is a complex and multifactorial condition, with excessive mechanical loads on the trunk believed to cause injuries, degeneration, and LBP. Biomechanical risk factors, such as task-related and personal-related parameters, have been identified in the onset or progression of LBP. Body weight (BW) has been a subject of debate, with some studies indicating it as a strong risk factor for LBP, intervertebral disc herniation, and osteophytes, while others consider it as a possible weak or non-contributing risk factor. Musculoskeletal biomechanical models are valuable tools for cross-validating LBP risk factors and shedding light on associations between personal-related factors and LBP.

**3.15** XIAN XU, XU LI, WEI WU. had Studiesin 2015 **Association between overweight or obesity and lumbar disk diseases.** A total of 5 studies satisfied the predefined eligibility criteria, including 1749 cases with lumbar disk diseases and 1885 controls. Altogether, overweight was associated with increased risk of lumbar disease [95% confidence interval (CI)]. Moreover, subgroup analysis proved that overweight was a predominant factor in development of lumbar disease compared with age and sex. Although significant publication bias was observed in our meta-analysis, we proved high credibility of meta-analysis result using Trim And Fill method (OR= 1.27; 95% CI, 1.06, 1.53).

**3.16** BJÖRN KNUTSSON, BENGT SANDÉN. Had a study in 2015. **Body mass index and risk for clinical lumbar spinal stenosis.** in this study they find that at baseline, 65% had normal weight (BMI [body mass index]: 18.5–24.99 kg/m2), 29% were overweight (BMI: 25–29.99 kg/m2), 5% were obese (BMI ≥30 kg/m2), and 2% were underweight (BMI 2). During 11,190,944 person-years of follow-up, with a mean of 31 years, 2381 participants were diagnosed with LSS;Compared with normal weight

individuals, obese workers had an IRR of 2.18 (95% confidence interval, 1.87–2.53) for LSS and overweight workers had an IRR of 1.68 (95% confidence interval, 1.54–1.83). Workers who were underweight halved their risk of LSS (IRR: 0.52, 95% confidence interval, 0.30–0.90).

**3.17** zahaf, S., Mansouri, B., Belarbi, and Azari, Z. study in (2015) **Obesity Effect on the Spine.** A better understanding of moving mechanisms of spine under different loads and stress distribution in this system is of fundamental importance in the advancement of technologies in the areas of spinal restorations inter vertebral prostheses, and osteopathic medicine bone. The degeneration of the lumbar discs is definitely related to BMI; overweight and obesity are associated with a higher risk of problems of the spine. Rheumatism, the Journal of the American College of Rheumatology, alerts on this effect of overweight in the development of degenerative disc disease and back pain and then herniated disc. two vertebrae of the spinal column with an intervertebral disc under the effect of a compound loading (compression P + bending moment P1).This pressure will there after generate the disc degeneration or degenerative disc disease.

**3.18** Author links open overlay panelM. Hajihosseinali, N. Arjmand, A. Shirazi-Adl study in 21January 2015 **Effect of body weight on spinal loads in various activities: A personalized biomechanical modeling approach.** However, earlier models have accounted only for changes in the upper BW without considering alterations in inputs on the anatomy of muscles, mechanical properties of the ligamentous spine, and moment arm of gravity loads at different spinal levels. Lifting analysis tools like the 3D Static Strength Prediction ProgramTM, the revised Hand-Calculation Back Compressive Force model, and the polynomial equation of low back compression all consider BW as an input but fail to scale foregoing parameters accordingly. Particularly in flexed postures, the L5–S1 compression and shear stresses significantly increased with BW (Fig. 4, Fig. 5). The L5–S1 compression increased by ~80–147% when the BW increased from 51 to 119 kg. It also increased by ~46–52% when the task involved holding a load in flexed posture, by ~25% when the weight was held close to the chest in an upright posture, and by ~12% when the weight was held away from the chest in an extended posture (Fig. 4). Similarly, when BW rose from 51 to 119 kg.

**3.19**

**3.20** W. Brinjik ji,P.H. Luetmer, B. Comstock, B.W. Bresnahan,L.E. Chen, R.A. Deyo,S. Halabi,J.A. Turner,A.L. Avins, K. James,J.T. WaldD.F. Kallmes,and J.G. Jarvik study in 2015 Thirty-three studies reporting imaging findings for 3110 asymptomatic people matched our research inclusion criteria. The prevalence of disk deterioration in asymptomatic people rose from 37% of 20-year-olds to 96% of 80-year-olds. The prevalence of disk bulges rose from 30% of those aged 20 to 84% of those aged 80. The prevalence of disk protrusions rose from 29% of those aged 20 to 43% of those aged 80. Annular fissures became more common as people aged from 20 to 80.

**3.21** Knutsson, Björn MD*; Sandén, Bengt MD, PhD*; Sjödén, study in September 2015. **Body Mass Index and Risk for Clinical Lumbar Spinal Stenosis.** A prospective cohort study was conducted on 364,467 construction workers in Sweden, aiming to determine if overweight and obesity are associated with a higher risk of lumbar spinal stenosis (LSS). LSS has become the most common indication for spine surgery in recent decades, coincidentally with a higher prevalence of obesity. The study used Poisson regression models to estimate multivariable-adjusted incidence rate ratios (IRRs) for LSS. Results showed that at baseline, 65% had normal weight, 29% were overweight, 5% were obese, and 2% were underweight. During 11,190,944 person-years of follow-up, 2381 participants were diagnosed with LSS. Obese workers had an IRR of 2.18 for LSS, while overweight workers had an IRR of 1.68. Underweight workers had a half-halved risk of LSS. The study concluded that obesity and overweight individuals are at a higher risk of developing LSS and that obesity might be a novel explanation for the increased number of patients with clinical LSS.

**3.22** Joachim Raastad, Michael Reiman, Remy Coeytaux, Leila Ledbetter, Adam P. Goode, study in April 2015. **The association between lumbar spine radiographic features and low back pain:** A systematic review and meta-analysisThis study aimed to determine the association between low back pain (LBP) and lumbar spine radial (RF) features in both community- and occupation-based groups. A systematic electronic search was conducted on PubMed, EMBASE, CINAHL, and Cochrane, with a focus on studies of adults aged 18 years and older with and without nonspecific LBP. The search was restricted to studies related to infection, malignancy, rheumatologic nature, or conducted in cadavers. The results showed a significant positive association between disc space narrowing and LBP, which did not differ in both community- and occupation-based.

**3.23** Leila Ledbetter, Adam P. Goode, study in April 2015. The association between lumbar spine radiographic features and low back pain**:** A significant association was found between spondylolisthesis and LBP in occupation-based studies, which differed significantly from community-based studies. The association between other radiographic features was modest or non-significant.The quality of included studies varied, with the majority demonstrating good quality. In conclusion, a significant association was found

between disc space narrowing in both community- and occupational-based populations without significant differences between the associations. A significant strong association was found between spondylolisthesis and LBP among the occupational group but was weakly associated in the community-based group, supporting the possibility that spondylolisthesis may contribute a specific cause for LBP.

**3.24** SergiyV. Kushchayev, TetianaGlushko, Mohamed Jarraya, Karl H. Schuleri, Mark C.Preul, Michael L. Brooks &Oleg M.Teytelboym study in march 2018 **ABCs of the degenerative spine.** Two adjacent vertebrae, the intervertebral disc, spinal ligaments and facet joints between them constitute a functional spinal unit Degenerative change is considered a response to insults, such as mechanical or metabolic injury, rather than a disease.The etiology of the degenerative changes may be mechanical micro-insults or damage secondary to macro-insults, such as spinal fractures, spinal surgery not related to degenerative disc disease or significant metabolic processes, such as ecchondrosis or mucopolysaccharidoses.All elements of the spine.

**3.25** SergiyV. Kushchayev, TetianaGlushko, Mohamed Jarraya, Karl H. Schuleri, Mark C.Preul, Michael L. Brooks &Oleg M.Teytelboym study in march 2018 **ABCs of the degenerative spine.** including the intervertebral discs, joints, ligaments and bony structures, may undergo morphological changes that can be classified as degenerative. Therefore, understanding the pathophysiology of these biomechanical changes in the spine is essential for radiologists to characterize radiological abnormalities.The pathophysiology-based approach in assessing imaging findings in the degenerative spine can: accurately characterize the process in the involved segment; identify the sequence of degenerative changes and predict further abnormalities;identify hidden or subtle abnormalities based on indirect signs; assist clinicians in finding the source of pain or neurological symptoms; identify the best treatment options for patients.Commonly, the degenerative process may include other elements of the involved functional spinal unit, which we term horizontal or segmental degeneration, or change the entire biomechanics of the spine, including the adjacent functional spinal units, know as an adjacent segment disease. Advanced degeneration may eventually involve distant structures and lead to facet joint osteoarthritis, ligamentum flavum hypertrophy and spinal canal stenosis.

**3.26** Chantal S. Parenteau, Edmund C. Lau, Ian C. Campbell. study in 8 march 2021. **Prevalence of spine degeneration diagnosis by type, age, gender, and obesity.**In evaluating spine trauma, it is relevant to understand the prevalence of degenerative spine pathologies.Types of spinal degenerative pathologies examined in this study include stenosis, spine curvatures (kyphosis, lordosis, and scoliosis), diffuse idiopathic skeletal hyperostosis (DISH), spondylitis, osteoporosis, and disc degeneration. Spondylitis refers

to inflammation of the joints of the spine.Degeneration of intervertebral discs is a common finding in the spine7,8 and may include pathologies such as disc bulges, disc herniations, osteophyte formation, loss of disc height, and disc desiccation.Osteophytes, or bone spurs, often protrude from the edges of vertebral endplates and sometimes bridge the intervertebral disc space.Medicare insurance claims represent a large database that can provide insight into the prevalence of spine degeneration and associated demographic factors.The objective of this study is to assess the prevalence of specific diagnoses pertaining to spinal degeneration as a function of age, sex, and obesity, as well as an investigation of the influence of radiological imaging on the rate of diagnosis of such conditions.

**3.27** Daniel J Bell study in 2023 **Spondylosis**. Repetitive movements wear down the vertebral body endplates, compromising vascular supply to the central part of the intervertebral disc (made up of the nucleus pulposus and annulus fibrosus).Further disc desiccation results in disc herniation through the posterior annular tear.The bulging disc causes the posterior longitudinal ligament to peel off from the surface of the vertebral body. Discharniation irritates the posterior adjoining ends of the vertebrae, causing the new bone formation, known as an osteophyte.As osteophyte formation increases.

**3.28** J Bell study in 2023 Spondylosis causes the narrowing of spinal canal, compressing the spinal cord, resulting in a condition known as ‘‘hyperostotic myelopathy ‘‘However, the awkward‘‘kyphotic position of the spine gives rise to more stress of the other vertebral levels, resulting in progression of spondylosis to other vertebrae.When spinal stenosis is present, either forward (impacting theosteophytes) or backward movement (impacting the hypertrophied ligamentum flavum) of the spine will cause further canal narrowing and compresses the spine, increasing the risk of spinal cord damage, thus causing compressive myelopathy or chronic spinal cord ischemia.Spinal cord ischemia is usually due to small perfusion defects as a result of long period of small collisions with the narrowed canal instead of absence of larger blood supply to the spinal cord.

**3.29** Lindsay Curtis; Neal Shah; Devang Padalia.study in 2023 **Facet Joint Disease.** Facet joint disease is a condition in which the joints of the spine become a source of pain.This activity reviews the evaluation and treatment of facet joint disease and highlights the role that the interprofessional team plays in treating patients with this condition.Facet joints form from the superior and inferior articular processes of two adjacent vertebrae.Facet joint mediated pain is a common source of disability amongst our population with significant economic impact.Thisprevalence is consistent with the idea that degeneration is the leading contributory cause of facet joint disease, as the elderly population is more often affected.However, having a history of doing heavy work before age 20 increases the likelihood of developing facet joint osteoarthritis. Obesity

also largely contributes to osteoarthritis; thus, it is likely a contributing factor in the development of facet joint disease. Spondylolisthesis caused by degeneration is most often caused by facet joint osteoarthritis, and typically occurs at the L4-L5 level. Cervical facet disease and pain have a prevalence rate of 29 to 60% following whiplash injuries; although overall trauma is still a rare cause.

**3.30** María OrosiaLucha-López study in 2 August 2023 **Body Mass Index and Its Influence on Chronic Low Back Pain in the Spanish Population.** A Secondary Analysis from the European Health Survey. Sedentary lifestyles and obesity are risk factors that lead to the development of persistent low back pain. The aim of this study is to characterize the relationship between body mass index (BMI) and the prevalence of chronic low back pain in the general Spanish population, as well as to evaluate this relationship in light of other variables such as age, sex, physical demands at work, and recreational physical activity. Methods: Secondary data from the European Health Survey in Spain (2020) were used to conduct an analytical cross-sectional design. Information was gathered on age, gender, physical demands at work, physical activity, BMI, and the existence of persistent low back pain. Results: A total of 19,716 participants (52.2% women) with a 53-year-old median age were examined. Of these, 16.1% were overweight, 39% had chronic low back pain, and 18.3%.

# CHAPTER -4

# METHODOLOGY

## 4.1 STUDY SITE

Department of Radiology, Santosh Hospital Ghaziabad U.P.

## 4.2 DESIGN OF STUDY

Prospective observational and cross-sectional study

## 4.4 STUDY DURATION

January 2024 to July 2024

## 4.5STUDY POPULATION

Western U.P.

## 4.6 PARTICIPANTS

The patients who are sent to the radiology department for a lumber spine CT examination are the data's primary source. Both OPD and IPD Patients are included in the study.

## 4.6 SAMPLE SIZE

359 Patients

## 4.7CRITERIA

Convenient sampling.

## 4.8 INCLUSION CRITERIA

Patients from IPD and OPD with CT Abdomen examination.

Male and Female of both gender above 25 year.

## 4.9 EXCLUSION CRITERIA

Patients with lower back pain or lower limb radiculopathy.

Both genders below 25 years.

Contra indicated patients for CT.

## 4.10 STUDY POPULATION

In this study, 359 patients are involved.

## 4.11 Method of Data Collection

We will use a **GE Healthcare** workstation to take CT lumber spine images of patients referred by various departments in the department of radio diagnosis at Santosh Hospital and Research Centre, Ghaziabad, that all of the inclusion criteria, collect data and reconstruct using various computed tomography reconstruction software. The 2-dimensional axial, coronal and sagittal

images data using MPR,which will be documented on the case record sheet. The imaging was carried out utilizing GE Healthcare 128 slice MDCT and in accordance with departmental protocol.

### 4.12 Techniques of Examination

Firstly, take a history from patient and its prescription and screened the patients before entering in scan room for all the radio-opaque objects in region of interest to prevent from artifact in image. Elucidate the examination to the patient then lie the patient on CT couch in Feet first position and cover the area from Level of epigastric region to below the inferior border of the pubic symphysis and plan the patient for exam. Give instruction to patient for no any movement during exam. Enter the patient information in console monitor and select for spine helical examination and take a topogram of lumber spine and select the Level from t 12 level of vertebra to sacrum and start scan in helical mode. CT protocol (KVp, mA, slice thickness, Interstice Gap) protocol also include axial plan with 3- 5mm thickness, there by reconstruction, post processing and reformatting images into multiple planes.

### 4.13 Image evaluation

Numerous reconstructed images were received after the machine made its MPR and was diagnosed blindly by a radiologist, identifying the pathologies shown in the image. And write with precision and detail.

### 4.13 Performances and Specifications of the examination

#### i. Technical Parameters

While many aspects of a CT scanner's functioning are automated, a few technical aspects remain depend on the operating business. Given that these factors may have a significant impact on how well the CT test predicts outcomes, the following:

- Factors of exposure (MAs, KVp)
- Pre-& Post Collimator.
- Demonstration of slice thickness for multidetector scanner
- Rotation time and couch speed
- Detector configuration systems
- Automatic control exposure
- Radiation measured quantity report
- Reconstruction technique such as back filtered projection or iterative reconstruction

#### ii. Equipment Specifications

- Scanning time 8 second image direct axial acquisition.

- Image thickness: 3-5mm.
- Algorithm available: medium smooth, bone with sharpness (SS40) Filter
- Axial mode available on CT scanner.

A PACS workstation will be available to the radiologist, and certified medical personnel should be able to see the image remotely. There should be a method for automatically transferring image data.

### 4.14 Data Analysis

- The data were inputted into an Excel spreadsheet.
- The data analysis for this study will involve a BMI based data that are measured with the patient waist circumflex ratio.
- Readability Assessment Tools were used are

### 4.15 Ethical Approval

Ethical approval was obtained from the Ethical Committee of Santosh Deemed to be University, Ghaziabad.

## 4.14 CT TECHNIQUES AND PROTOCOL

| PROTOCOL | CT LUMBER SPINE |
|---|---|
| Patient position | **Supine** |
| Patient orientation | **Feet first** |
| Topogram | **Anteroposterior** |
| Planning | **level of epigastric region to 3cm belowthe inferior border of the pubic symphysis** |
| Scan type | **Helical** |
| Scan orientation | **Caudo-Cranial** |
| Slice thickness | **5mm** |
| Slice gap/Slice increment | **5mm** |
| KVp | **120** |
| Mas | **200-250** |
| Noise | **10-15 % MaS** |
| Scan Delay | **4 -6 Seconds** |
| Recon Algorithm | **Thin 0.625 mm, Bone (2000w/w-350w/l)** |

**Table 2: CT PROTOCOL OF LUMBER SPINE**

## CHAPTER – 5

## RESULTS

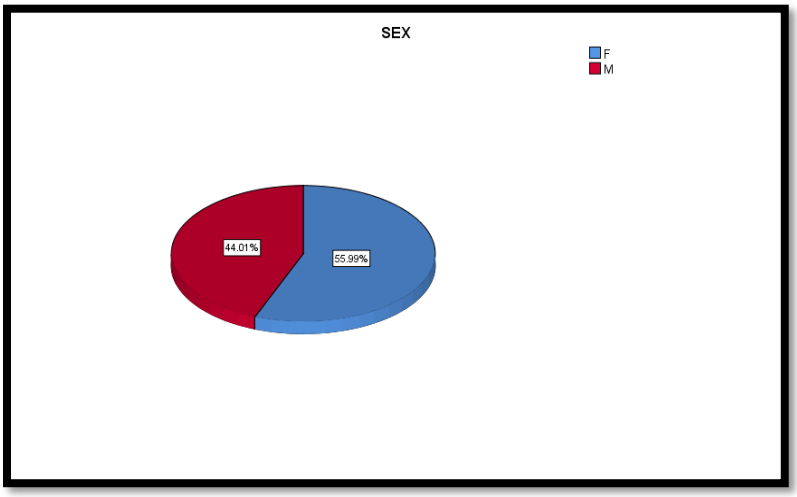
This study held on the supervision of the Santosh Hospital senior technician and Dr. A total of 359 patients is included in this study who were referred to the radiology department at Santosh Hospital underwent this cross-sectional prospective study.

- Recode age (20 thru 35=1) (36 thru 50=2) (51 thru 65=3) into age_ new.
- Execute.
- Recode BMI kg/m2 (lowest thru 23=1) (23 thru highest=2) into BMI_ new.
- Execute.
- Frequencies variables = sex
- occupation = normal & hard
- degenerative changes including these pathologies = osteophytes
- kyphosis, low disc Hight
- spinal cord compression
- facet joint changes
- spondylolisthesis
- lumbarization,

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| F | 201 | 56.0 | 56.0 | 56.0 |
| M | 158 | 44.0 | 44.0 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 3:Table showing sex of the patient

According to table -3 The data illustrates that in this sample, a majority of respondents are female (56%), while a smaller proportion are male (44%).The cumulative percentage confirms that the sum of the percentages for all categories equals 100%, ensuring a complete and accurate representation of the sample's gender distribution.



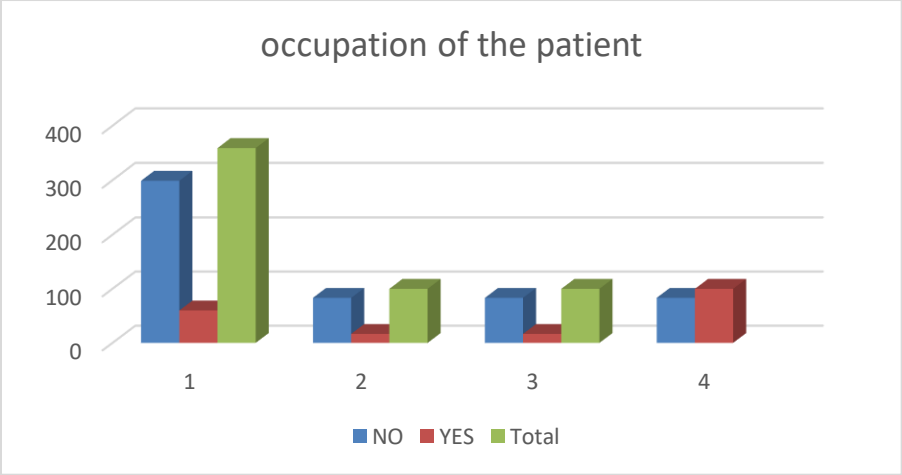

Graph-1 showing Gender Distribution

According graph-1this chart is showing that 44.01% are male that have same changes in his spine or different changes in his spine and its ratio is lower than female. Female which is 55.99% is included in this study which have degenerative changes in his lumber spine

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| HARD | 214 | 59.6 | 59.6 | 59.6 |
| NORMAL | 145 | 40.4 | 40.4 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 4 :Table showing occupation of the patient

According to table- 4 : The table provides a detailed breakdown of the occupation types within the sample population. Individuals in "HARD" occupations constitute 59.6% of the sample, making this category more prevalent compared to "NORMAL" occupations. Individuals in "NORMAL" occupations make up 40.4% of the sample. The cumulative percentage confirms that the sum of percentages for all categories equals 100%, indicating a complete and accurate representation of the occupation distribution within the sample.



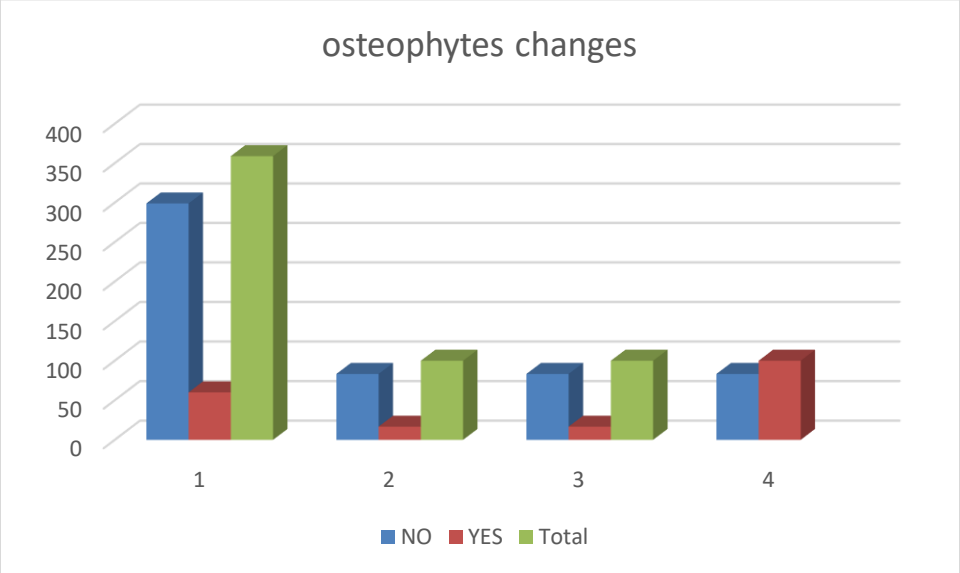

Graph 2: - showing occupation of the patient

According graph-2: Showing that patient which have hard occupation are more effected with all changes. Or which are normal occupation like office work or sitting work. has low frequencies in degenerative. In this chart 40.39% patient belong from normal occupation but 59.61% patient are come from hard occupation or hard work is currently doing or they have done in past.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 174 | 48.5 | 48.5 | 48.5 |
| YES | 185 | 51.5 | 51.5 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 5:Table showingdegenerative change in osteophytes of patients.

According to table- 5: The table details the distribution of individuals with respect to their osteophyte's status within the sample. 48.5% of the sample fall into the first osteophytes category (174). 51.5% of the sample fall into the second osteophytes category (185). The total cumulative percent confirms that these two categories together encompass the entire sample, with no missing data.



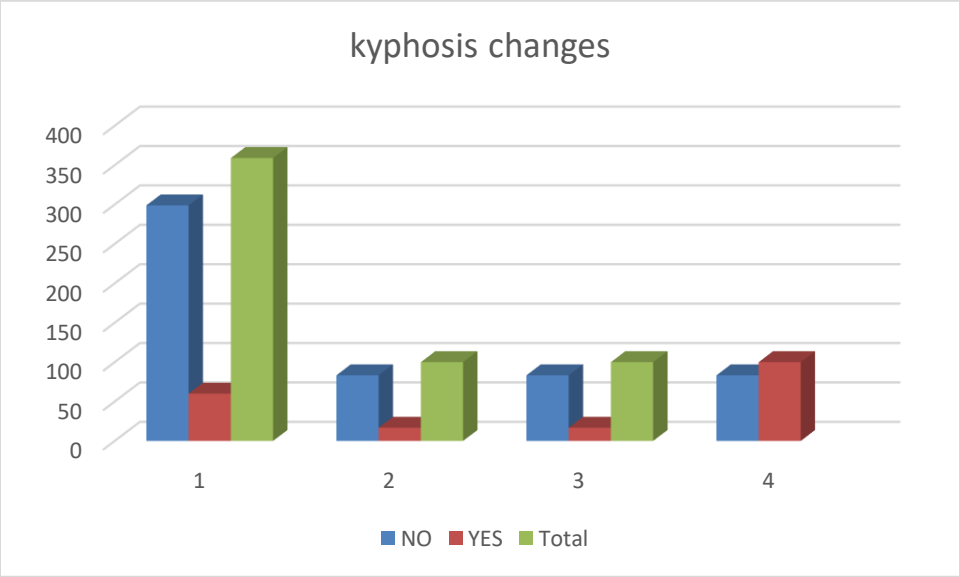

Graph 3 - showingdegenerative change in osteophytes of patients.

According graph-3 indicates that out of the 359 patients, 51.53% had osteophytes alterations in their lumber spines. Bony growths called osteophytes develop on the spine's bones or surrounding joints. They don't usually create issues, but they do occur when arthritis damages a bone or joint.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 204 | 56.8 | 56.8 | 56.8 |
| YES | 155 | 43.2 | 43.2 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 6:Table showing degenerative change in kyphosis of patients.

According to table – 6 :The table provides a distribution of individuals based on their kyphosis status. 56.8% of the sample does not have kyphosis (NO), indicating that more than half of the respondents fall into this category. 43.2% of the sample has kyphosis (YES), showing a notable but smaller proportion with the condition. The total cumulative percent confirms that these two categories together encompass the entire sample, with 100% of the responses accounted for.



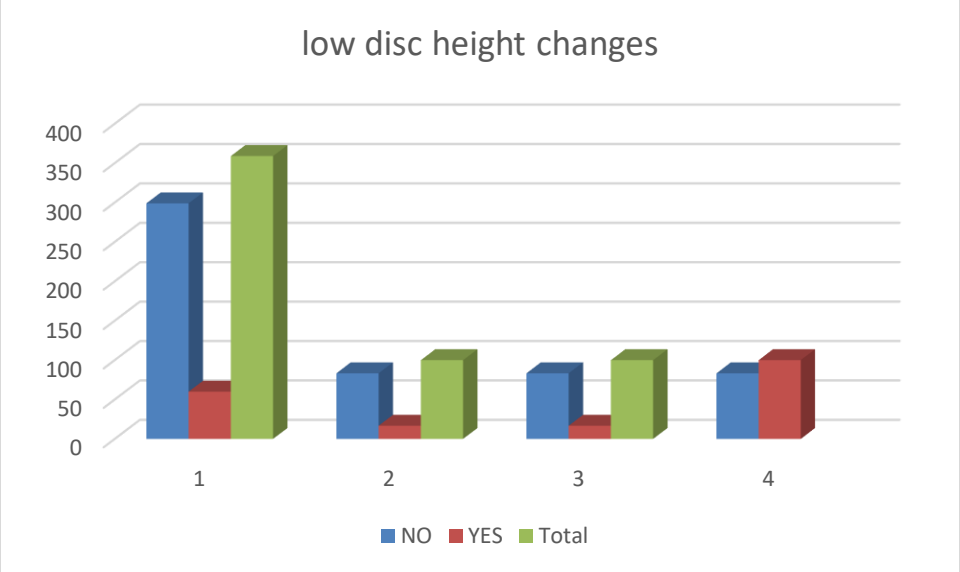

Graph 4 - showingdegenerative change in kyphosis of patients.

According graph-4 :This graphic indicates that out of the 359 patients, 43.18% had alterations in their kyphosis in their lumber spine. To put it another way, 56.82% of patients have further alterations or might be normal. An excessive forward rounding of the upper back is called kyphosis.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 206 | 57.4 | 57.4 | 57.4 |
| YES | 153 | 42.6 | 42.6 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 7:Table showing degenerative change in low disc height of patients.

According to table - 7: The table illustrates the distribution of individuals based on their low disc height status within the sample. **57.4%** of the sample has low disc height, indicating a majority of individuals fall into this category. **42.6%** of the sample does not have low disc height, representing a smaller proportion.The cumulative percentage confirms that these two statuses together cover the entire sample, with no missing data.



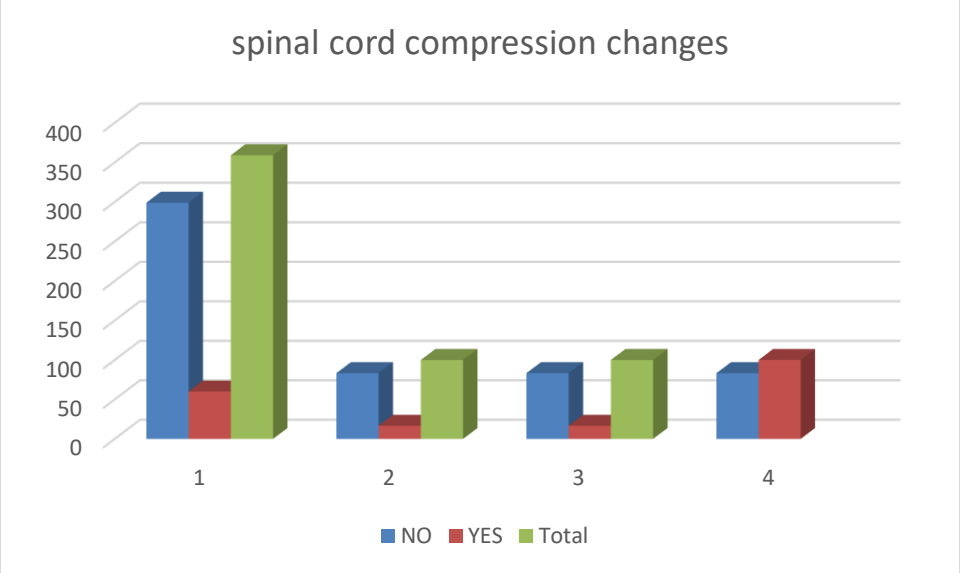

Graph 5 - showingdegenerative change in low disc height of patients.

According graph-5 This graphic indicates that out of the 359 patients, 42.62% had alterations in their low disc Hight in their lumber spine. To put it another way, 57.38% of patients have further alterations or might be normal. Discs may grow rigid and lose height as a result of Disc Degenerative Disease, however. Loss of disc height can lead to bone and joint inflammation, nerve impingement, and discomfort.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 211 | 58.8 | 58.8 | 58.8 |
| YES | 148 | 41.2 | 41.2 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 8: Table showing degenerative change in spinal cord compression of patients.

According to table – 8:The table shows the distribution of spinal cord compression cases. Out of 359 observations, 58.8% (211 cases) reported no spinal cord compression, while 41.2% (148 cases) did report it. The cumulative percentages indicate that 58.8% of the data falls into the "NO" category, and the "YES" category accounts for the remaining 100% of the dataset.



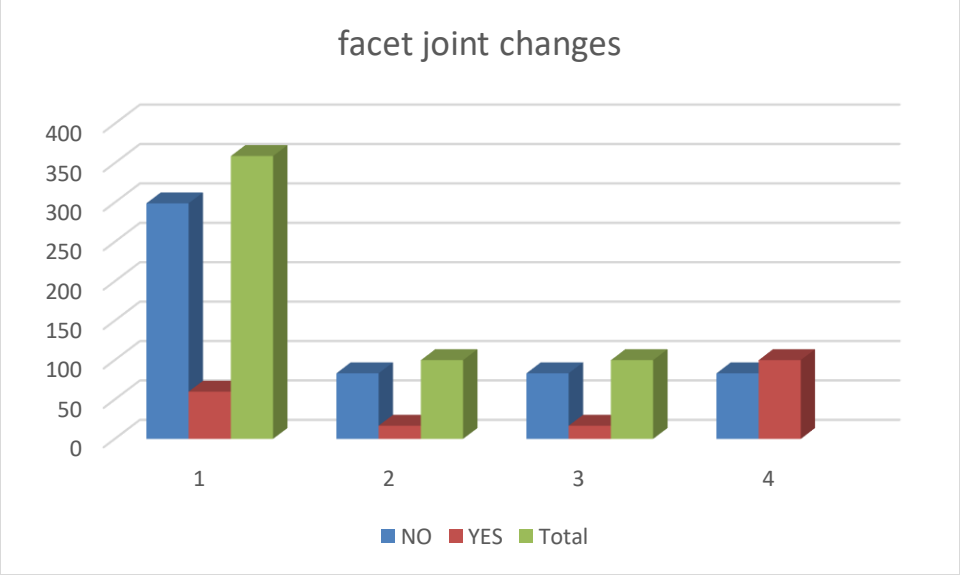

Graph 6 - showingdegenerative change in spinal cord compression of patients.

According graph-6This graphic indicates that out of the 359 patients, 41.23% had alterations in their spinal cord compression in their lumber spine. To put it another way, 58.77% of patients have further alterations or might be normal.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 206 | 57.4 | 57.4 | 57.4 |
| YES | 153 | 42.6 | 42.6 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table9: Table showing degenerative change in facet joint of patients.

According to table – 9: The table illustrates that Out of the total sample of 359 cases, 57.4% (206cases) reported no facet joint changes, while 42.6% (153 cases) exhibited facet joint changes.



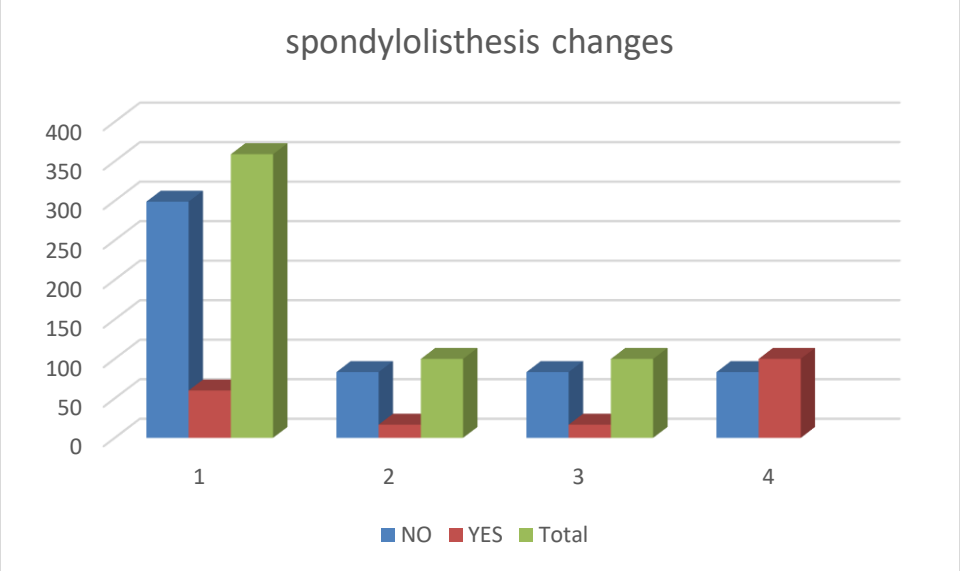

Graph 7 - showingdegenerative change in facet joint of patients.

According graph-7 The graph depicts that facet joint changes are present in 42.6% of the cases, while the majority, 57.4%, do not exhibit these changes

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 205 | 57.1 | 57.1 | 57.1 |
| YES | 154 | 42.9 | 42.9 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 10 : Table showing spondylolisthesis degenerative change in patients.

According to table – 10 :The table shows the The percentages reflect the proportion of cases within the total valid responses, showing that 57.1% of the valid cases are in the "NO" category and 42.9% in the "YES" category.



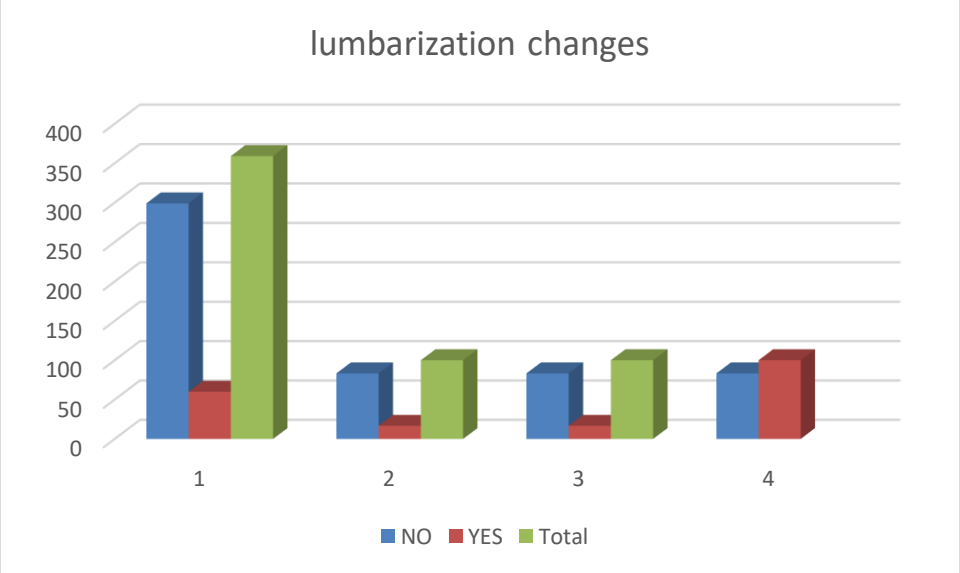

Graph 8 - showing spondylolisthesis degenerative change in patients.

According graph-8 Above graph determines that spondylolisthesis is observed in 42.9% of the cases, while the majority, 57.1%, do not have this condition.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 233 | 64.9 | 64.9 | 64.9 |
| YES | 126 | 35.1 | 35.1 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table11: Table showing lumbarization degenerative change in patients.

According to table - 11:The above table illustrates that out of the total sample, 64.9% (233 cases) do not have lumbarization, whereas 35.1% (126 cases) exhibit lumbarization.



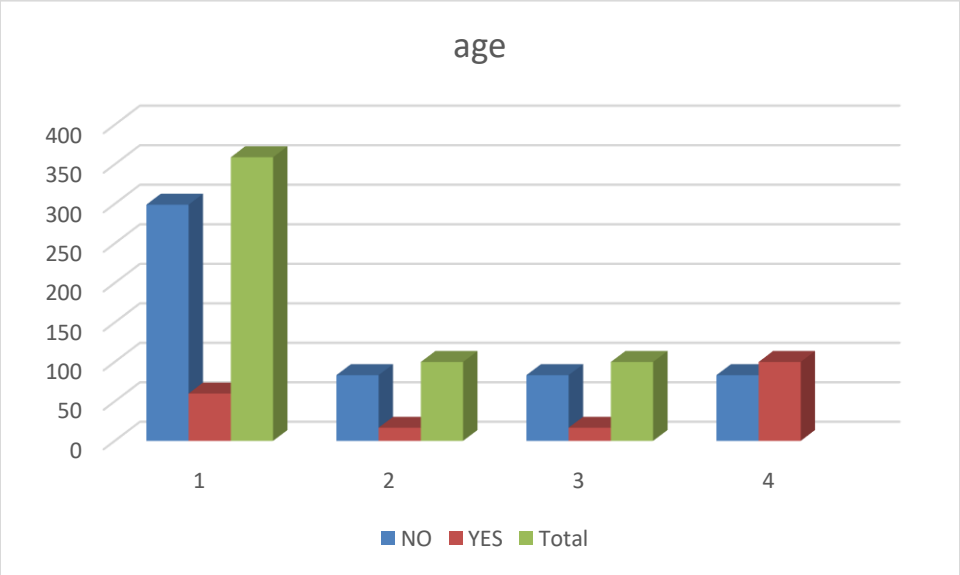

Graph 9 - showing lumbarization degenerative change in patients.

According graph 9- graphic indicates that lumbarization is present in 35.1% of the cases, while 64.9% do not have this condition.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| 20-35 | 112 | 31.2 | 31.2 | 31.2 |
| 36-50 | 125 | 34.8 | 34.8 | 66.0 |
| 51-65 | 122 | 34.0 | 34.0 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 12: Table showing age of the patient

According to table - 12: The table shows the sample is relatively evenly distributed across the three age ranges, with the highest proportion (34.8%) in the 36-50 years group.  4.8% of the sample, or 125 individuals, are in this age bracket 36-50 while 34.0% of the sample, or 122 individuals, belong to 51-65 years group.



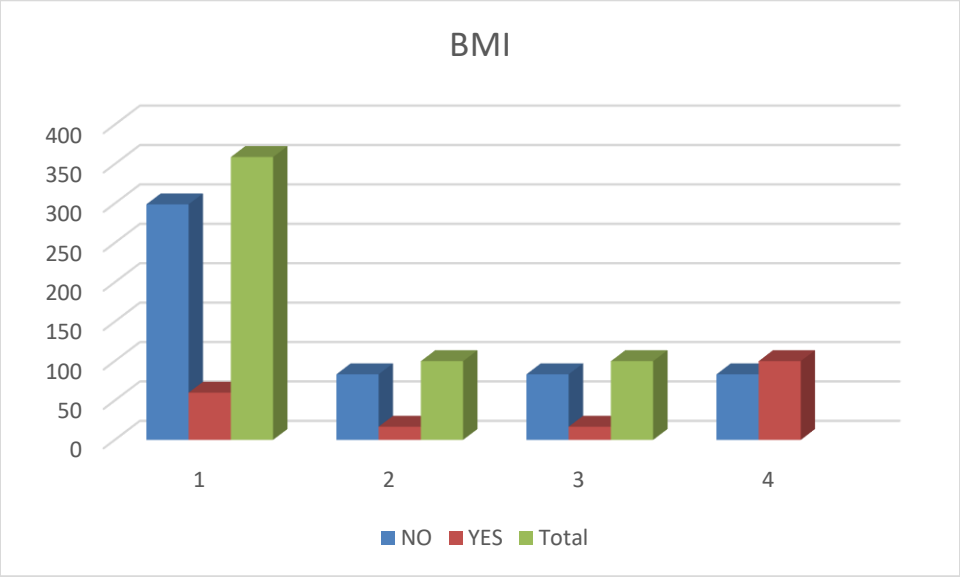

Graph 10 - showing age of the patient

According graph 10:This graphic representation indicates that the highest proportion (34.8%) in the 36-50 years group.  4.8% of the sample, or 125 individuals, are in this age bracket 36-50 while 34.0% of the sample, or 122 individuals, belong to51-65 years group.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| <=23 | 2 | .6 | .6 | .6 |
| >23 | 357 | 99.4 | 99.4 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 13:Table showing BMI of the patient

According to table -13: The above table data indicates that nearly all individuals (99.4%) have a BMI greater than 23,while only a very small fraction (0.6%) have a BMI of 23 or less.



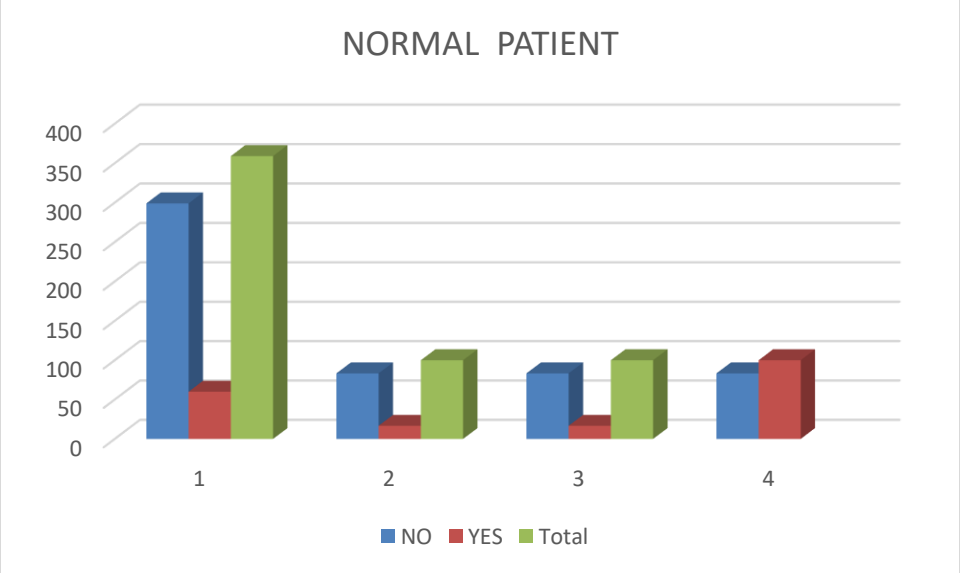

Graph 11 - showing BMI of the patient

According graph-11:The above graph data indicates that nearly all individuals (99.4%) haveBMI greater than 23, while only a very small fraction (0.6%) have a BMI of 23 or less.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| NO | 299 | 83.3 | 83.3 | 83.3 |
| YES | 60 | 16.7 | 16.7 | 100.0 |
| Total | 359 | 100.0 | 100.0 | |

Table 14:Table showing normal patient

According to table -14: The above table data indicates that nearly all individuals (83.3%) have a, degenerative changes in lower back. while only a very small fraction (16.7%) have normal spine but they have also included in higher BMI.




Graph 12 - showing no changes or normal patient

According graph-12: The above graph data indicates that nearly all individuals (83.3%) have a, degenerative changes in lower back. while only a very small fraction (16.7%) have normal spine but they have also included in higher BMI.

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .404[a] | 1 | .525 | | |
| Continuity Correction | .000 | 1 | 1.000 | | |
| Likelihood Ratio | .734 | 1 | .392 | | |
| Fisher's Exact Test | | | | 1.000 | .693 |
| N of Valid Cases | 359 | | | | |

Table 13:Table Showing Association of ratings with demographic variables

INTERPRETATION: The Pearson Chi-Square Test assesses the independence between two categorical variables. With a chi-square value of 0.404 and a p-value of 0.525, the test suggests that there is no significant association between the variables at a common significance level (e.g., 0.05). A p-value greater than 0.05 implies that any observed difference is likely due to chance rather than a significant relationship between the variables. The Continuity Correction is applied to the Chi-Square test for 2x2 tables to adjust for the approximation made by the Chi-Square test. A p-value of 1.000 indicates no evidence of a significant difference between the variables. The extremely high p-value confirms that the variables are not significantly related, even when the continuity correction is considered. The Likelihood Ratio Test, an alternative to the Pearson Chi-Square Test, also assesses the association between variables. The p-value of 0.392 is greater than the conventional significance level (0.05), indicating that there is no significant association between the variables. Fisher's Exact Test is used for 2x2 tables, particularly when sample sizes are small or when the expected frequencies are low. The p-value of 1.000 (2-sided) and 0.693 (1-sided) confirm that there is no significant association between the variables. All tests (Pearson Chi-Square, Continuity Correction, Likelihood Ratio, and Fisher's Exact Test) suggest no significant relationship between the variables being analyzed. The high p-values in each test support the conclusion that any observed differences are likely due to random variation rather than a meaningful association.

## RECOMMENDATIONS

1. Weight accumulation should be publicly discouraged by public health education to prevent the worsening symptoms of LDD.
2. Implement weight loss programs for overweight and obese patients to reduce mechanical stress on the lumbar spine.
3. Encourage a balanced diet and regular physical activity tailored to individual capabilities and health status.
4. Educate patients about the relationship between BMI and spinal health. Highlight the importance of maintaining a healthy weight for spine health.
5. Promote exercises that strengthen core muscles, improve flexibility, and support the spine. These can include yoga, pilates, and low-impact aerobic exercises.
6. Provide physical therapy to improve posture, mobility, and reduce pain associated with lumbar spine degeneration.
7. Conduct regular follow-ups for patients with high BMI to monitor changes in spinal health. Use imaging techniques like MRI or CT scans when necessary.
8. Launch public health campaigns to raise awareness about the impact of obesity on musculoskeletal health, including the lumbar spine

## CHAPTER-6

## DISCUSSION

**M Liuke**, highlights that a BMI above 25 kg/m² is linked to an increased risk of lumbar disc degeneration, particularly emphasizing that this risk is more pronounced when the high BMI occurs at a younger age compared to middle age. The study's findings suggest that while there is a significant correlation between overweight and disc degeneration, the small sample size limits the precision of these estimates. Therefore, further research with larger sample sizes and diverse settings is necessary to validate these results.

**Paul Dimitri.** the complex relationship between obesity, bone size, and fracture history in children. It concludes that some pathologies are majorly seen in short time when obesity are over on body Reduced Bone Mass Obese children generally exhibit lower bone mass relative to their body size, with even more pronounced reductions in those with a history of fractures. This suggests that obesity negatively impacts bone architecture. Fracture as a Marker A history of fractures is associated with narrower bones, indicating altered bone structure. Obesity exacerbates this issue, leading to an increased risk of fractures. Mechanical Response The study posits that obesity may impair the skeleton's ability to respond to mechanical loading, resulting in insufficient bone growth despite normal physical activity levels. Osteoporosis Risk A significant percentage of obese children may qualify as osteoporotic, underscoring the urgency of addressing bone health in this demographic, especially during critical growth phases. Long-Term Implications The findings suggest potential long-term skeletal health issues, as achieving optimal peak bone mass during adolescence is essential for future bone health. Overall, the research underscores the need for proactive measures to manage obesity and its effects on bone health in children to prevent future complications.

This research presents a review of the A degenerative changes in lumbar vertebrae caused by BMI and age at Santosh Hospital. Several factors were identified and analyzed in this study, including conducting regular follow-ups for patients with high BMI to monitor changes, providing physical therapy to improve posture, mobility, and reduce pain associated with lumbar spine degeneration, and educating patients about the link between BMI and spinal health.

Emphasize the significance of keeping a healthy weight for spinal health. To decrease degenerative changes, the patient must follow a balanced diet and engage in frequent physical exercise that is suited to their specific talents and health state. The study's statistical population consisted of 359 patients in total out of 750, with 100 being included. The primary goal of this study was to evaluate the degenerative changes in lumbar vertebra with the influence of BMI and age at Santosh Hospital. This involves assessing the lumbar vertebrae to determine the occurrence of degenerative alterations as a result of BMI and age.

The research was conducted using a prospective observational and cross-sectional design. the researchers employed an observational checklist to perform their investigation. The study revealed that there is no significant relationship between the factors at a common significance level, namely SPONDYLOLISTHESIS, BMI, LUMBARIZATION, FACET JOINT, and SPINAL CORD COMPRESSION. From the checklist, it was found that weight buildup should be publicly discouraged by public health education to prevent the deteriorating symptoms of LDD and execute weight loss programmed for overweight and obese people, to minimize mechanical stress on the lumbar spine. There is always room for improvement in order to reduce the degenerative processes.

## CHAPTER – 7

## CONCLUSION

This study consistently shows that obesity is a significant risk factor for degenerative changes in the lumbar spine. Increased body weight places additional mechanical stress on spinal structures, which can lead to disc degeneration, facet joint arthritis, and other related conditions. Additionally, obesity contributes to systemic inflammation, further accelerating these degenerative processes. Addressing obesity through lifestyle modifications is essential for preventing or mitigating spinal degeneration and enhancing overall health.Recommendations for the Public for awareness.

1. **Promote Healthy Weight Management**: Encourage balanced diets rich in fruits, vegetables, whole grains, and lean proteins. Implement community programs that provide resources for healthy eating.
2. **Increase Physical Activity**: Advocate for regular physical activity that includes both aerobic exercises and strength training. Aim for at least 150 minutes of moderate aerobic activity each week.
3. **Education and Awareness**: Increase public awareness about the links between obesity and spinal health. Educational campaigns can help inform individuals about the importance of maintaining a healthy weight for preventing degenerative spinal conditions.
4. **Access to Resources**: Improve access to weight management programs, nutrition counseling, and fitness facilities, particularly in underserved communities.
5. **Support Systems**: Encourage the establishment of support groups for individuals looking to lose weight and improve their health. Community support can significantly enhance motivation and adherence to lifestyle changes.
6. **Regular Health Screenings**: Promote routine health check-ups that include assessments of weight, body mass index (BMI), and spinal health to identify at-risk individuals early.

By focusing on these strategies, we can help reduce the prevalence of obesity and its associated degenerative effects on the lumbar spine, leading to improved quality of life for many individuals.

## CHAPTER-8

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## CHAPTER – 9

## ANNEXURES

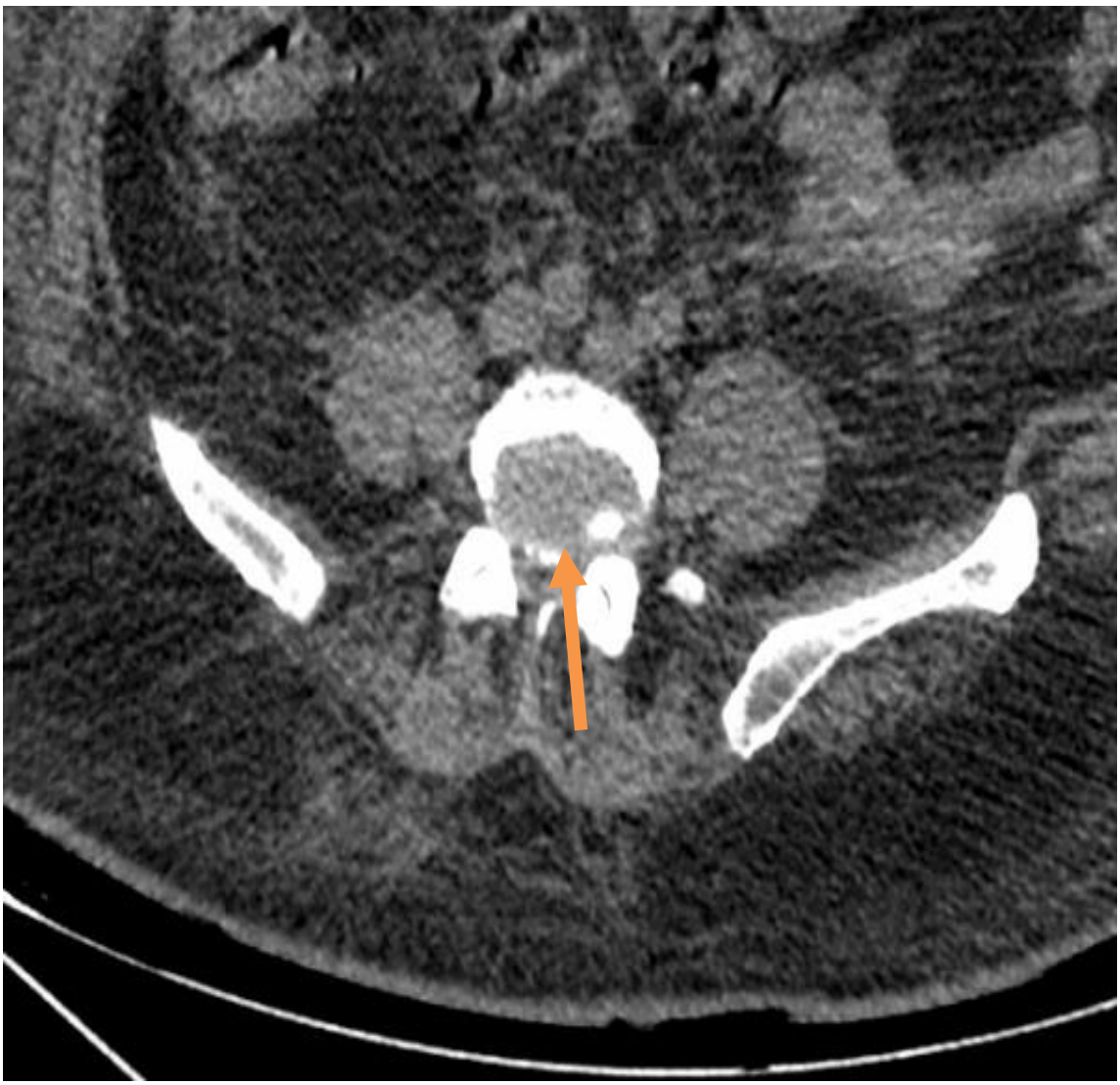

Fig. 21:- This lumbar spine axial picture demonstrates a disc herniation.

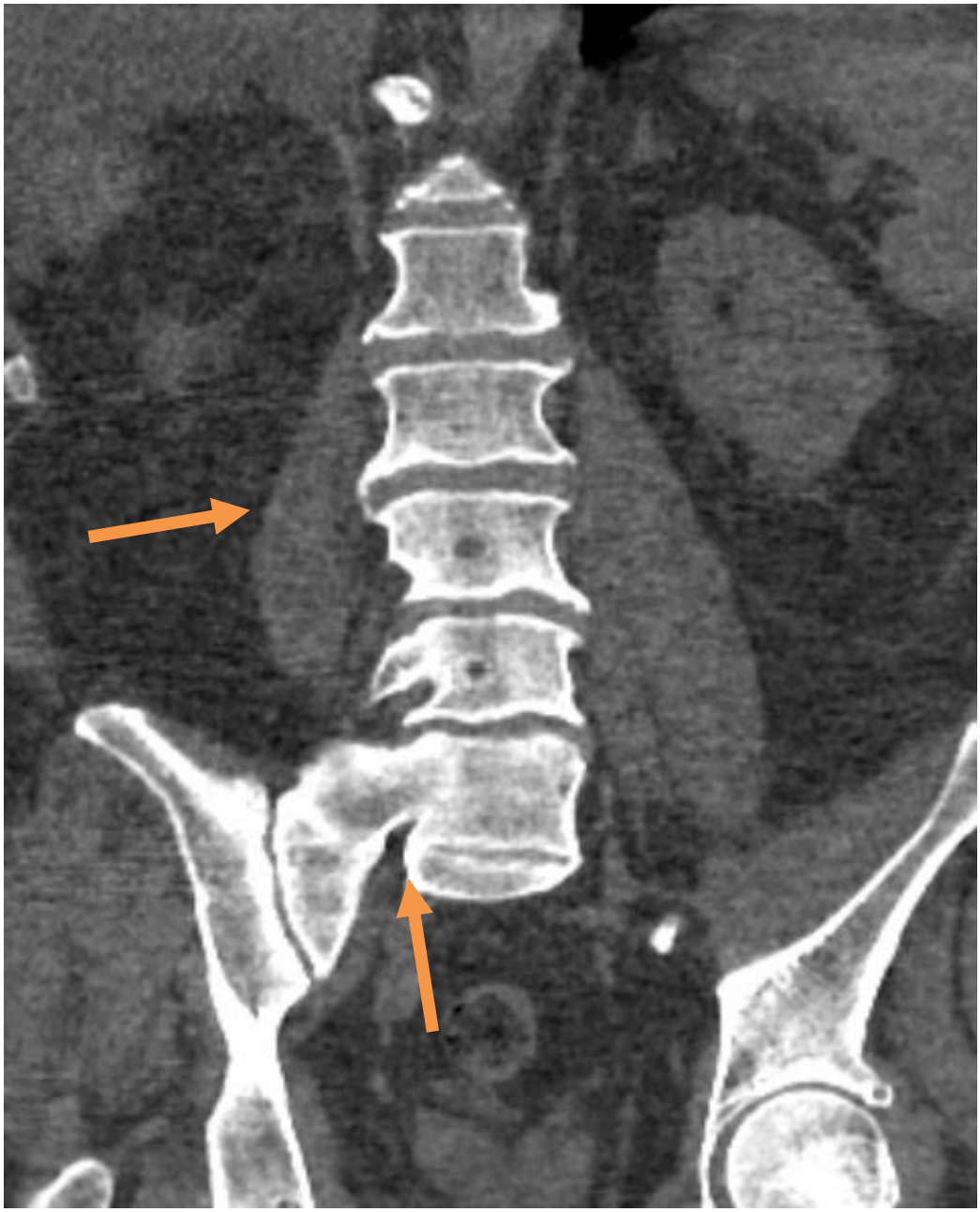

Fig :- 22 The anterior side osteophytes are visible in the umber spine's coronal plane.

Fig:- 23 this sagittal plane of lumber spine is  showing low disc hight .

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Subject: Grant of Ethical Clearance for **Dissertation Protocol** Topic **"A Study to Assess the Degenerative Changes in Lumber Vertiba- Effect of BMI & Age",** submitted by **ANURAG TIWARI,** student of M.Sc. Medical Imaging Technology, 2022 Batch.

*****

With reference to the request for grant of Ethical Clearance for the Dissertation Protocol entitled **"A Study to Assess the Degenerative Changes in Lumber Vertiba- Effect of BMI & Age"**, **ANURAG TIWARI** is informed that the **Dissertation Protocol** submitted by him/her was considered by the **Screening Committee** of the **Allied Health Sciences** in its meetings held on 07.02.2024 and 29.02.2024. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **15.05.2024** and the same was **approved** by the **Ethics Committee** of the **Santosh Deemed to be University, Ghaziabad, Delhi NCR**.

He /She is informed accordingly for further necessary action.

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